

California Department of Water Resources
Division of Operations and Maintenance
Water Quality Section

Water Quality Assessment of the State Water Project, 1996-1997



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Gray Davis
Governor
State of California

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Acronyms and Abbreviations

af	acre-feet		
Ag	silver	Mg	magnesium
Al	aluminum	Mn	manganese
As	arsenic	mp	milepost
B	boron	MTBE	methyl-tertiary-butyl ether
Ba	barium	n	number
Br	bromide	N	nitrogen
Ca	calcium	Na	sodium
Cd	cadmium	NH ₄	ammonia
cfs	cubic feet per second	NO ₂	nitrite
Cl	chloride	NO ₃	nitrate
CO ₃	carbonate	NTU	nephelometric turbidity unit
Cr	chromium	P	phosphorus
Cu	copper	Pb	lead
CVP	Central Valley Project	pH	negative log of the hydrogen ion activity
DHS	Department of Health Services	PO ₄	phosphate
DMC	Delta-Mendota Canal	Se	selenium
DOC	dissolved organic carbon	SLC	San Luis Canal
DWR	Department of Water Resources	SO ₄	sulfate
EC	electrical conductivity	SRI	Sacramento River Index
EPA	Environmental Protection Agency	SWP	State Water Project
F	fluoride	TDS	total dissolved solids
Fe	iron	TOC	total organic carbon
Hg	mercury	TSS	total suspended solids
K	potassium	THM	trihalomethane
MCL	maximum contaminant level	TTHMFP	total trihalomethane formation potential
MFL	million fibers per liter	USBR	United States Bureau of Reclamation
mg/L	milligrams per liter	µg/L	micrograms per liter
		µmole/L	micromoles per liter
		µS/cm	microseimens per centimeter
		WQT	water quality threshold
		Zn	Zinc

I. Executive Summary

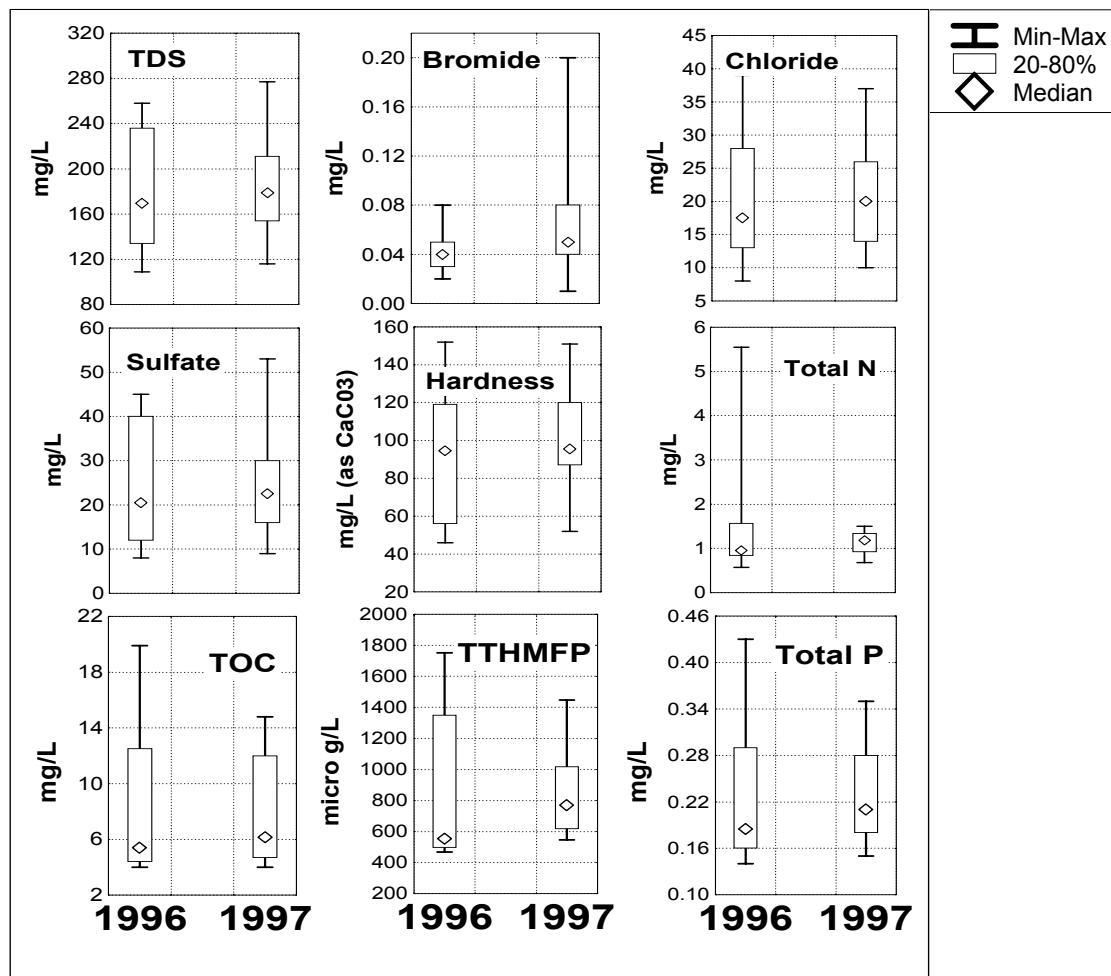
Water quality in the State Water Project was affected by several specific events during 1996-97. Above-normal runoff contributed to higher levels of organic carbon and trihalomethane formation potential in the California Aqueduct during 1996. Runoff also produced increases in organic carbon, turbidity, dissolved metals, and nutrients by up to two orders of magnitude in the North Bay Aqueduct. Alternately, saltwater intrusion in the Delta produced a fourfold increase in bromide in the California Aqueduct toward the end of 1997. Another source of salinity was year-round inflows to Pyramid Lake from Piru Creek that contributed substantially to West Branch salt loads. The Executive Summary discusses these and other trends with respect to important drinking water parameters such as salts, organic carbon, and nutrients.

Annual and Seasonal Trends

North Bay Aqueduct

In the North Bay Aqueduct at Barker Slough Pumping Plant, TOC, TTHMFP, and nutrients were more variable in 1996, while bromide varied greatest in 1997 (Figure 1-1). Most parameters were highest during the rainy season of both years. During 1996, TOC ranged between 3 to 5 mg/L during the summer, but increased to 20 mg/L during a December storm event. Winter increases were also observed

Figure 1-1
Annual Water Quality Summary in the North Bay Aqueduct,
Barker Slough Pumping Plant



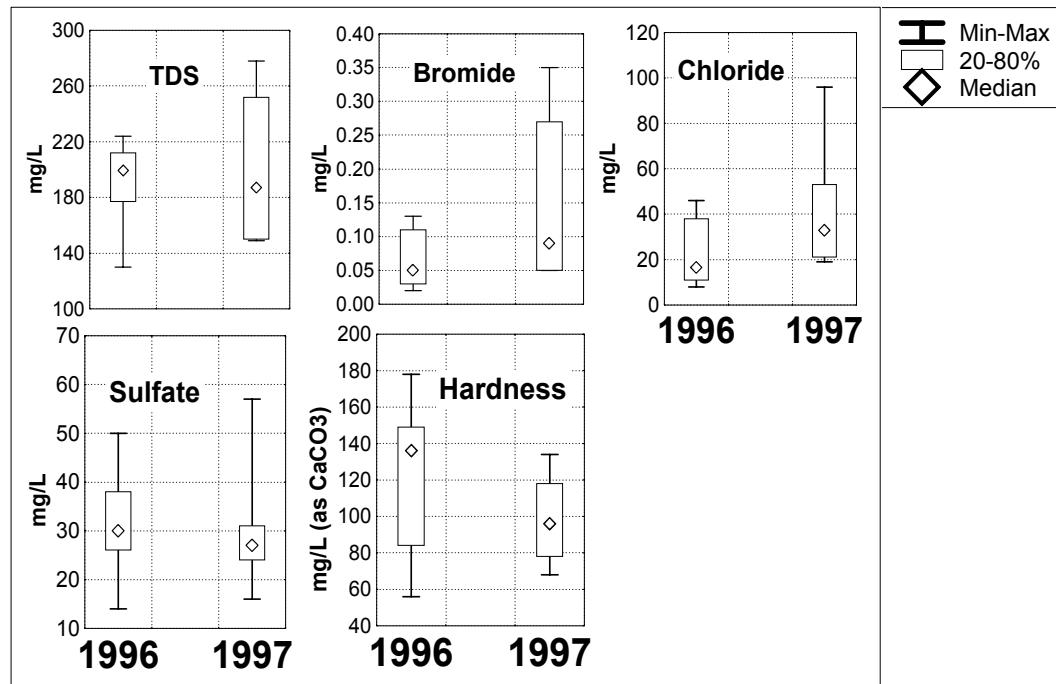
for TTHMFP, total phosphorus, and total nitrogen. Concentration increases were related to rainfall runoff in the upstream watershed.

Parameters such as sulfate, chloride, and hardness were highest during the spring months of both 1996 and 1997. A similar trend was observed for bromide when concentrations increased through winter, peaked in April or May, then declined towards the end of summer. The higher spring concentrations were likely due to increased groundwater accretion from the upstream watershed. One sample collected in October 1997 contained bromide at 0.2 mg/L—more than twice the level in all other samples. Such an increase might indicate salinity intrusion, but a corresponding rise in TDS did not occur.

South Bay Aqueduct

In the South Bay Aqueduct at Santa Clara Terminal Tank, TDS, bromide, and chloride were highest in 1997 (Figure 1-2). The higher 1997 levels occurred during the last few months of the year when salinity intrusion in the Delta affected salt concentrations throughout the Project. Conversely, hardness was higher in 1996 than 1997 and coincided with releases from Del Valle Reservoir. Monitoring for nutrients, TTHMFP, and TOC began in 1997 at Check 7 on the South Bay Aqueduct, and all were routinely detected above their reporting limits.

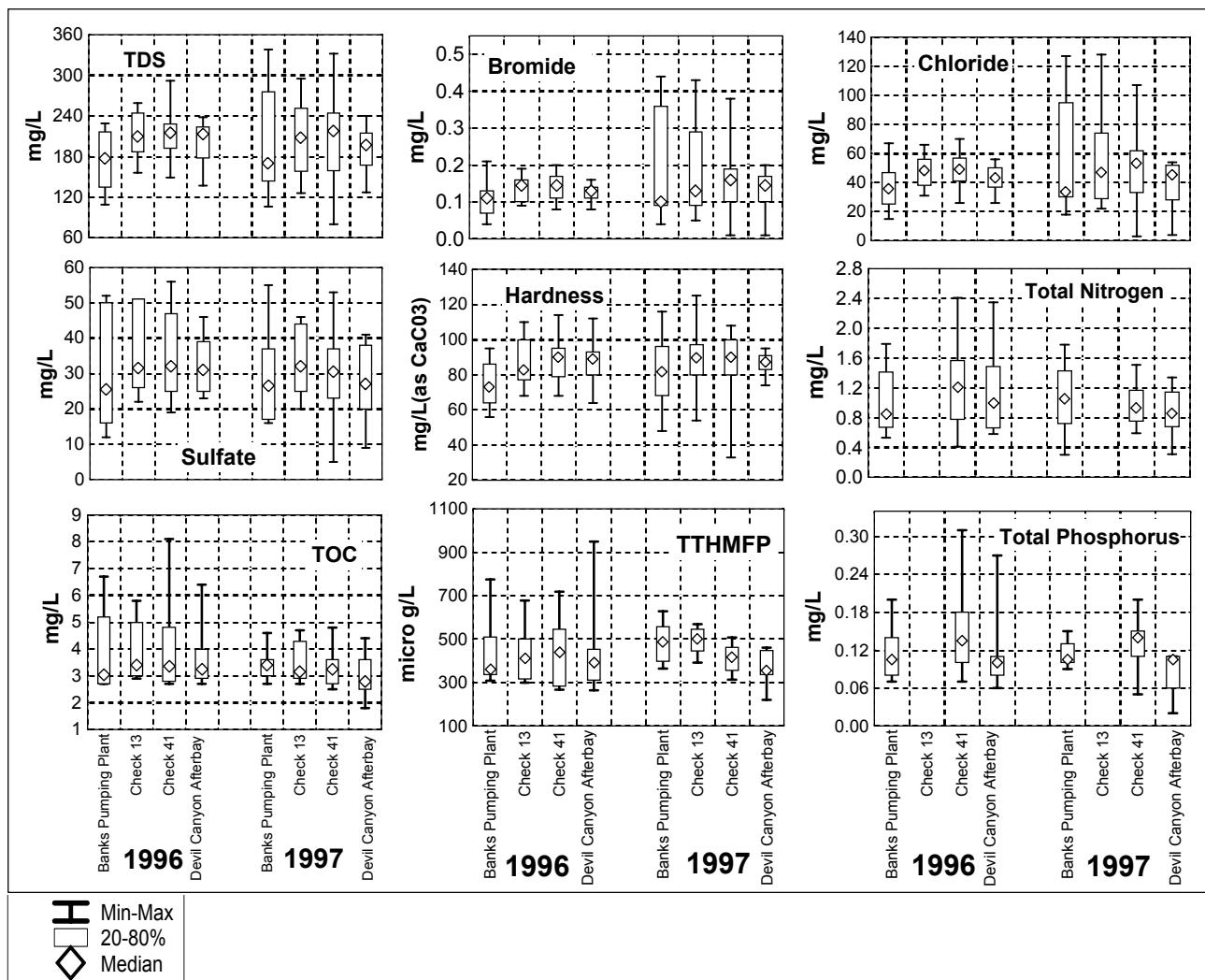
Figure 1-2
Annual Water Quality Summary in the South Bay Aqueduct, Santa Clara Terminal Tank



California Aqueduct

Chloride, bromide, and TDS were more variable in 1997 than 1996 at most Aqueduct stations (Figure 1-3) and this variability was the result of two distinct events. First, salt levels increased toward the end of 1997 due to salinity intrusion in the Delta. At Banks Pumping Plant, TDS exceeded 250 mg/L and

Figure 1-3
Annual Water Quality Summary in the California Aqueduct



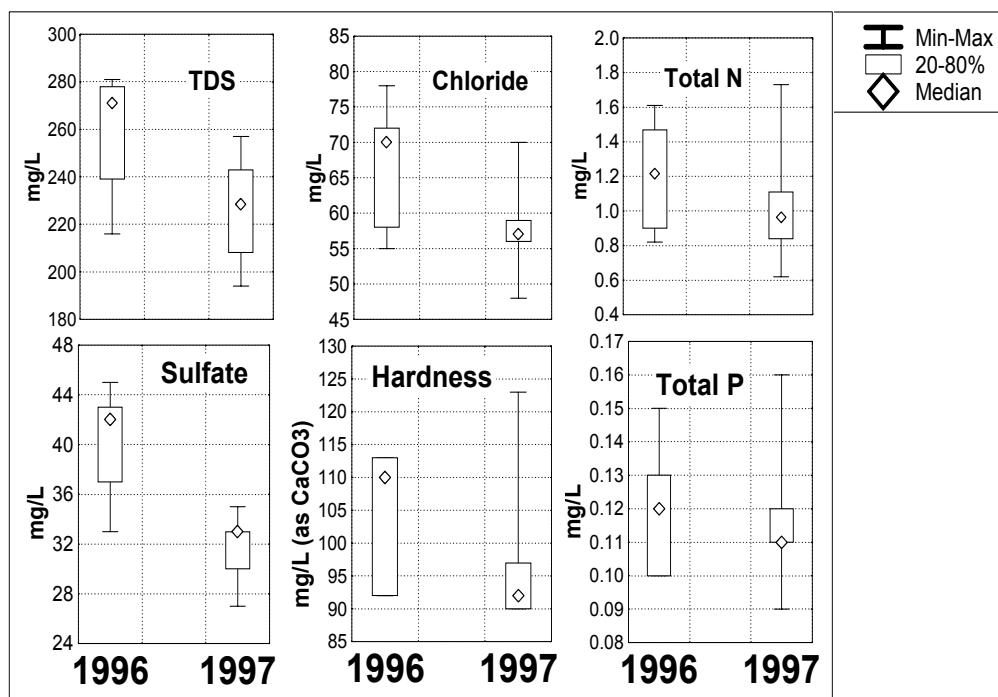
bromide exceeded 0.3 mg/L from October to December 1997. Conversely, Kern River inflows lowered TDS and other salt-related parameters at stations south of Check 29 during January and February 1997. TOC at all Aqueduct stations was higher in 1996 when concentrations ranged from 2.7 to 8.1 mg/L, compared to 1.8 to 4.8 mg/L in 1997. During both years, the highest levels were usually measured in winter when rainfall runoff from the Central Valley was greatest. An unusually high TOC value of 8.1 mg/L was detected at Check 41 in July 1996, but there was no corresponding increase in TTHMFP. No non-Project inflows were reported for that month. Both compounds were elevated at Devil Canyon Afterbay during February 1996, possibly from upstream floodwater inflows to the San Luis Canal. The following February at the same station, TOC and TTHMFP dropped to the lowest levels measured in the Project during the 2-year period. Kern River inflows and local runoff contributed to this decline. Monthly total nitrogen and phosphorus trends were similar to those for TOC and TTHMFP during 1996 but not 1997.

San Luis Reservoir

Median annual TDS in San Luis Reservoir declined from 271 mg/L in 1996 to 228 mg/L in 1997 (Figure 1-4). A similar reduction was observed for chloride, sulfate, and hardness. Monthly salt

concentrations remained relatively constant in 1996 until October when they began declining. This decline was related to reservoir filling (from Delta pumping) that started in September and continued into 1997. Reservoir salinity has been steadily decreasing since 1993—the end of the 1987-92 drought. Median total nitrogen and phosphorus levels were also higher in 1996 than 1997, but the highest concentrations were detected in the fall of 1997.

Figure 1-4
Annual Water Quality Summary in San Luis Reservoir



Pyramid Lake

Average TDS, sulfate, and hardness levels in Pyramid Lake declined between 1996 and 1997 (Table 1-1). Concentration declines were greatest in 1996 while monthly levels in 1997 remained relatively constant. Piru Creek was responsible for the higher 1996 levels due to extremely high inflows the previous year that accounted for about 35 percent of all inputs to the lake. Chloride did not exhibit the same trends, because Piru Creek contains very little chloride compared to Project inflows. The highest levels of total nitrogen and phosphorus were measured in 1996, but seasonal trends were not consistent.

Table 1-1
Annual Water Quality Summary in Pyramid Lake

Parameter, mg/L	1996				1997			
	Mean	Low	High	# of Samples	Mean	Low	High	# of Samples
Total Dissolved Solids	277	233	339	4	236	232	240	4
Sulfate	74	55	107	4	51	45	57	4
Hardness (as CaCO ₃)	127	112	160	4	109	100	115	4
Chloride	46	43	49	4	46	42	52	4
Total Nitrogen	1.0	0.5	2.4	11	0.8	0.7	1.0	12
Total Phosphorus	0.09	0.05	0.27	12	0.07	0.01	0.09	12

Castaic Lake

TDS, sulfate, and hardness levels in Castaic Lake declined between 1996 and 1997 (Table 1-2), and the decline occurred steadily throughout the 2-year period. TOC and TTHMFP levels were similar between years, although peak TOC levels occurred in May of each year while TTHMFP peaked in August 1996 and May 1997. Annual summaries of total nitrogen and phosphorus were similar between years, while seasonal trends were not.

Table 1-2
Annual Water Quality Summary in Castaic Lake

Parameter, mg/L	1996			# of Samples	1997			# of Samples
	Mean	Low	High		Mean	Low	High	
Total Dissolved Solids	378	331	406	4	308	279	325	4
Sulfate	121	102	129	4	89	78	98	4
Hardness (as CaCO ₃)	181	161	192	4	150	138	161	4
Chloride	52	50	54	4	45	43	48	4
Total Nitrogen	0.6	0.4	0.7	11	0.6	0.4	0.8	12
Total Phosphorus	0.04	0.02	0.07	11	0.03	0.02	0.06	12
Total Organic Carbon	4.6	3.4	5.7	4	4.0	2.9	5.8	4
Total Trihalomethane FP *	398	321	464	4	405	360	454	4

Special Investigations

Non-Project Inflows

Floodwater Inflows to the San Luis Canal. Floodwater inflows to the SLC were relatively minor in 1996 (341 acre-feet) and 1997 (2,136 af), compared to the 26,000 af discharged in 1995. Eighty-four percent of the 1996 inflows and 60 percent of the 1997 inflows originated from Cantua Creek.

Floodwaters were greatest during January 1997, but water quality impacts to the Aqueduct downstream were minimized by deliveries made from the SLC. During this month, federal contractors took 74 percent of the water entering the SLC from both Project and floodwater sources. Further, Aqueduct flows were limited during the same month because of Kern River inflows.

Kern River Intertie. In January and February 1997, 52,858 af of water was admitted to the California Aqueduct from the Kern River Intertie to relieve flooding east of the Aqueduct. Soon after inflows began, conductivity at Check 29 dropped from 387 µS/cm to between 80 and 100 µS/cm and remained at those levels for the duration of inflow—about 55 days. Similar trends were observed 62 miles downstream at Check 41.

Turbidity in the Aqueduct at Check 29 increased from 9 to 22 NTU the day after inflows began and remained between 20 and 70 NTU throughout the event. Turbidity at Check 41—62 miles downstream—did not change much as a result of Kern River inflows.

Pyramid Lake. Piru Creek inflows to Pyramid Lake totaled 19,352 af in 1996 and 19,496 af in 1997, amounting to about 5 percent of all inflows. In comparison, Piru Creek composed 35 percent of all inflows during 1995. These inflows had a major influence on the mineralogy of Pyramid Lake due to the creek's naturally high salt levels.

The mineral composition of Piru Creek is unique in that it contains an average concentration of chloride that is nine times lower than Project levels while sulfate averages eight times higher. This difference in

water types is reflected in Pyramid Lake, which, on average, contained an equal amount of chloride and sulfate in its anionic makeup during 1996-97, as opposed to Project water in which chloride was the dominant anion. The cationic composition was also altered from creek inflows.

Piru Creek accounted for about 12 percent of the total TDS load to Pyramid Lake during 1996-97 and 58 percent during 1995 (1995 was included to assess a high rainfall season). Contributions of individual minerals varied from less than 1 percent for chloride to about 28 percent for sulfate during 1996-97; in 1995, these values were 7 and 74 percent, respectively. Nitrogen and phosphorus loads from Piru Creek ranged from 1 to 3 percent during 1996-97 and from 15 to 31 percent in 1995.

Silverwood Lake. Local watershed inflows to Silverwood Lake totaled 11,714 af in 1996 and 8,980 af in 1997, amounting to about 2 percent of all inflows. Most inflows originate from Miller and Cleghorn creeks that, combined, drain about 60 square miles of watershed surrounding the lake. Salinity in both creeks is usually lower than Project water. Water quality changes from these streams were only apparent when Project inflows were low or non-existent. One such event occurred from November 1996 to February 1997, when local inflows increased and Project inflows decreased for 4 consecutive months. As a result, TDS in the lake and at Devil Canyon Afterbay declined by more than 50 mg/L. Miller and Cleghorn creeks contributed less than 2 percent of the TDS loads to Silverwood Lake in 1996-97 and 15 percent during 1995.

Effects of Dredging on San Luis Canal Water Quality

Dredging was conducted in the California Aqueduct during 1996 to remove sediment deposited by floodwater inflows the previous season. Sediment was dredged using a low-profile cutter head that suctioned material onto land west of the levee. Several locations between mileposts 157 and 163 were dredged. Extensive monitoring determined that no substantial changes in Aqueduct water quality occurred during the operation.

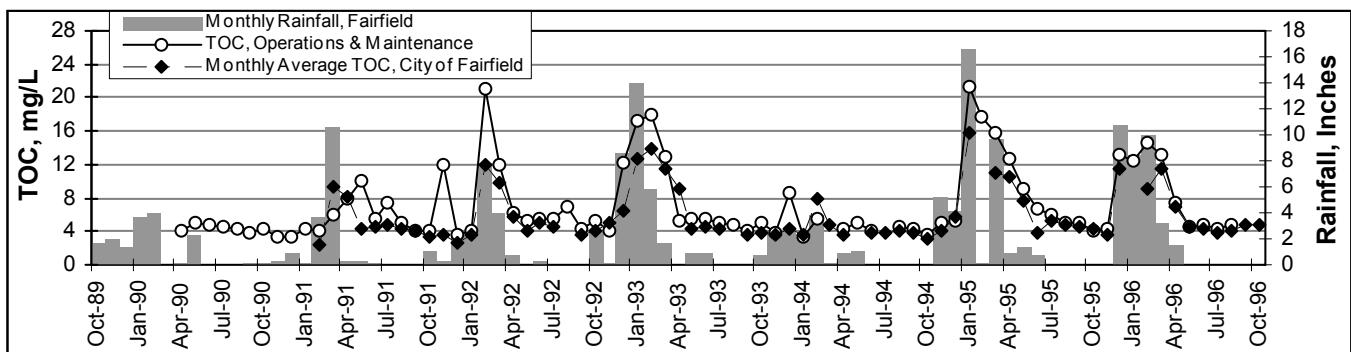
Oil Release in the California Aqueduct

On August 9, 1997, a small portion of California Aqueduct liner slumped into the water at milepost 62 when the Aqueduct was shut down for repairs upstream. On startup, oil was observed in the Aqueduct and flows were stopped until it could be contained. Absorbent booms were deployed downstream and monitoring for hydrocarbons began on a daily basis. Benzene, toluene, xylene, and ethylbenzene were detected in the Aqueduct for 6 days at various locations and all but one sample contained levels below the State MCLs. The oil was residual leftover from a 1984 pipeline leak at an Aqueduct crossing. Soil was excavated and a physical barrier was installed to intercept any further movement of groundwater toward the Aqueduct. Groundwater in the area continues to be treated by granular activated carbon.

Water Quality Assessment of the North Bay Aqueduct

Water treatment plants on the North Bay Aqueduct periodically experience surges of organic carbon in their raw water. Background TOC concentrations at Barker Slough Pumping Plant range between 3 and 5 mg/L during the summer months but can increase to over 20 mg/L during the rainy season. These surges coincide with rainfall events that produce runoff in the upstream watershed (Figure 1-5). Parameters such as total and fecal coliforms, dissolved ammonia, and organic nitrogen also increase during these events. During extremely wet seasons, rainfall lowers the pH in Barker Slough, increasing the levels of dissolved metals such as iron and manganese.

Figure 1-5
Rainfall and Total Organic Carbon at Barker Slough Pumping Plant, 1989-96



II. Introduction

Objectives

The Water Quality Section and five field divisions of the Division of Operations and Maintenance are responsible for overseeing and monitoring water quality in the State Water Project. Objectives of this monitoring are to:

- (1) assess the influence of hydrological conditions and water operations on Project water quality,
- (2) document long-term changes in Project water quality,
- (3) provide Project contractors with water quality data to assess water treatment plant operational needs,
- (4) identify, monitor, and respond to water quality emergencies and determine impacts to the Project,
- (5) assess the relative quality of Project water by comparing concentration data to Article 19 Objectives or Department of Health Services Drinking Water Standards, and
- (6) address water quality issues of particular concern.

Monitoring data from 1996-97 was assessed in this report to meet the above objectives. Prior water quality reports include DWR 1993, DWR 1995, and DWR 1997.

Monitoring Strategy

Water quality samples are routinely collected at 29 stations throughout the Project (Table A-1, Appendix A). Stations are distributed over a distance of more than 500 miles, from the upper Feather River watershed in Plumas County to Lake Perris in Riverside County (Figure A-1, Plates 1 to 5). Monitoring is conducted in the Feather River watershed, North Bay Aqueduct, South Bay Aqueduct, Coastal Branch, California Aqueduct—including its four terminus lakes—and the Central Valley Project's Delta-Mendota Canal.

Grab samples are collected by staff from the Oroville, Delta, San Luis, San Joaquin, and Southern field divisions on a monthly, quarterly, or as needed schedule. Subsurface samples are collected from a depth of between 1 to 9 feet at both channel and lake stations. Samples are transported to the Department's Bryte Chemical Laboratory within 24 hours of collection. Laboratory analyses have included inorganic and organic parameters such as major minerals, metals, and pesticides (Table A-1). Further details of field and lab methods can be found in Appendix A, Methods.

Automated water quality monitoring stations measure conventional parameters such as conductivity, temperature, or turbidity at 20 locations throughout the Project (Table A-2, Figure A-1, and Plates 1 to 5). Data are logged on an hourly basis and uploaded to O&M's Water Quality Homepage at <http://wwwomwq.water.ca.gov>. Data are also used to define hourly or daily water quality trends.

III. Annual and Seasonal Trends

This chapter describes annual and seasonal water quality trends in the State Water Project during 1996-97. Annual summaries for each monitoring station are presented in box and whisker plots or tables. Box and whisker plots show the median, 20th to 80th percentile range, minimums/maxima, and values one-and-a-half times outside the range of 20 to 80 percent. The latter values usually highlighted specific water quality events that were detailed in Special Investigations (Chapter IV).

Water quality parameters are presented in the following order: conventional parameters (e.g., pH, hardness) and major minerals, minor elements, nutrients, and organics (e.g., organic carbon, pesticides).

Standards and Objectives

Primary Drinking Water Standards, or Maximum Contaminant Levels, are the maximum permissible levels in a public drinking water supply. These standards must be met in finished drinking water (potable water) to protect human health. Since raw water in the Project is not required to meet MCL standards, comparisons are made with Project data to provide a relative indication of concentration.

Secondary Drinking Water Standards are consumer acceptance standards designed to protect taste, odor, color, and other aesthetic aspects of drinking water that do not present a health risk. Similar to Primary MCLs, they are used for comparison purposes only. Primary and Secondary MCLs are presented in Appendix B.

Article 19 objectives are included as standard provisions in the Department's water supply contracts. They require the collection and analysis of water quality samples in the Project and the compilation of records. Article 19(a) states:

“It shall be the objective of the State and the State shall take all reasonable measures to make available, at all delivery structures for the delivery of Project water to the District, Project water of such quality that the following constituents do not exceed the concentrations stated.”

These objectives are listed along with MCLs in Appendix B.

Conventional Parameters and Major Minerals

Conventional parameters include conductivity, hardness, lab pH, suspended solids, suspended volatile solids, field temperature, total dissolved solids (TDS), and turbidity. Major minerals include the cations calcium magnesium, potassium, and sodium, and the anions bicarbonate (alkalinity), chloride, nitrate, and sulfate.

Existing MCLs and Article 19 objectives for conventional parameters and major minerals are listed in Appendix B, Table B-1.

Feather River Watershed

All data from Project stations in the Feather River watershed during 1996-97 were below the Article 19 objectives or MCLs for finished drinking (Table 3-1). TDS ranged from 66 to 79 mg/L in Antelope and Frenchman lakes and from 40 to 59 mg/L in Lake Davis and Thermalito Afterbay. Calcium, magnesium, potassium, and sodium were 10 mg/L or less at all stations. Bicarbonate dominated the anionic composition while chloride, nitrate, and sulfate levels were near or below their respective reporting limits at all stations.

Table 3-1
Conventional Parameters and Major Minerals in the Feather River Watershed, 1996-97

Parameter	Station Name	I.D. #	1996			1997			# of Samples
			Median	Low	High	Median	Low	High	
Conductivity (Specific Conductance) µS/cm	Antelope Lake	AN001000	66			1	78		1
	Frenchman Lake	FR001000	99			1	100		1
	Lake Davis	LD001000	63			1	61		1
	Thermalito Afterbay	TA001000	75	71	80	11	73	60	81
Hardness mg/L as CaCO ₃	Antelope Lake	AN001000	26			1	28		1
	Frenchman Lake	FR001000	42			1	42		1
	Lake Davis	LD001000	23			1	23		1
	Thermalito Afterbay	TA001000	30	28	32	12	32	23	32
pH, Lab	Antelope Lake	AN001000	6.8			1	6.7		1
	Frenchman Lake	FR001000	7.0			1	6.8		1
	Lake Davis	LD001000	6.7			1	6.6		1
	Thermalito Afterbay	TA001000	6.8	6.7	7.1	11	6.7	6.6	7.8
Suspended Solids mg/L	Thermalito Forebay	TF001000	2			1			
	Thermalito Afterbay	TA001000	2	2	2	2	15	8	28
Suspended Volatile Solids mg/L	Thermalito Forebay	TF001000	1			1			
	Thermalito Afterbay	TA001000	2	1	2	3	2	2	3
Temperature Degrees C	Antelope Lake	AN001000	12.4				18.0		1
	Frenchman Lake	FR001000	11.8			1	17.0		1
	Lake Davis	LD001000	13.0			1	18.0	16.0	21.0
	Thermalito Forebay	TF001000	10.6	11.1	13.9	3	14.4	8.9	14.6
	Thermalito Afterbay	TA001000	12.8	8.9	18.9	12	13.9	7.2	18.9
Total Dissolved Solids mg/L	Antelope Lake	AN001000	69			1	68		1
	Frenchman Lake	FR001000	79			1	66		1
	Lake Davis	LD001000	54			1	47		1
	Thermalito Afterbay	TA001000	54	45	58	11	49	40	59
Turbidity, NTU	Thermalito Afterbay	TA001000	2	2	4	5	12	7	54
Calcium mg/L	Antelope Lake	AN001000	7			1	8		1
	Frenchman Lake	FR001000	10			1	10		1
	Lake Davis	LD001000	6			1	6		1
	Thermalito Afterbay	TA001000	7	6	8	11	7	6	8
Magnesium mg/L	Antelope Lake	AN001000	2			1	2		1
	Frenchman Lake	FR001000	4			1	4		1
	Lake Davis	LD001000	2			1	2		1
	Thermalito Afterbay	TA001000	3	3	3	11	3	2	3
Potassium mg/L	Antelope Lake	AN001000	1.2			1	1.6		1
	Frenchman Lake	FR001000	1.4			1	1.2		1
	Lake Davis	LD001000	1.1			1	1.0		1
Sodium mg/L	Antelope Lake	AN001000	4			1	4		1
	Frenchman Lake	FR001000	5			1	5		1
	Lake Davis	LD001000	3			1	3		1
	Thermalito Afterbay	TA001000	3	2	4	11	3	2	3
Bicarbonate (Alkalinity) mg/L as CaCO ₃	Antelope Lake	AN001000	32			1	44		1
	Frenchman Lake	FR001000	48			1	54		1
	Lake Davis	LD001000	30			1	33		1
	Thermalito Afterbay	TA001000	36	30	41	11	34	27	38
Chloride mg/L	Antelope Lake	AN001000	<1			1	1		1
	Frenchman Lake	FR001000	<1			1	1		1
	Lake Davis	LD001000	<1			1	1		1
	Thermalito Afterbay	TA001000	1	<1	2	11	1	1	1
Nitrate mg/L as NO ₃	Antelope Lake	AN001000	<0.1			1	<0.1		1
	Frenchman Lake	FR001000	<0.1			1	<0.1		1
	Lake Davis	LD001000	<0.1			1	<0.1		1
	Thermalito Afterbay	TA001000	<0.1	<0.1	0.2	11	<0.1	<0.1	0.2
Sulfate mg/L	Antelope Lake	AN001000	2			1	1		1
	Frenchman Lake	FR001000	2			1	1		1
	Lake Davis	LD001000	2			1	<1		1
	Thermalito Afterbay	TA001000	2	1	2	11	2	<1	2

North Bay and South Bay Aqueducts

On the North Bay Aqueduct at Barker Slough Pumping Plant and Cordelia Forebay, all data were below the MCLs for finished drinking water or applicable Article 19 objectives (Figures 3-1 and 3-2). Several parameters were highest during the winter, when Barker Slough Pumping Plant receives rainfall runoff from the upstream watershed. These seasonal events caused certain parameters to exceed background levels: turbidity, suspended solids, and nitrate in 1996, and pH and turbidity in 1997 (Figures 3-1 and 3-2). Figure 3-3 shows turbidity at Barker Slough Pumping Plant during 1997 was highest during January and February. An extremely low pH of 4.5 was measured in March 1997, but did not correspond with elevated levels of dissolved iron and manganese (see Minor Elements Section). Since a pH of this magnitude would usually be associated with elevated dissolved metal concentrations, the low measurement may have been field or laboratory error. Although it is not uncommon for pH at Barker Slough to decline when heavy rainfall overwhelms the buffering capacity of the watershed, pH at this station has never been measured below 6. Water quality issues in Barker Slough are detailed in Special Investigations (Chapter IV).

Sulfate, chloride, and hardness increased at Barker Slough Pumping Plant during the spring months of both 1996 and 1997 (Figure 3-4). This trend would suggest groundwater influence from the upstream watershed since accretion into Barker Slough would be greatest after the rainy season. Coastal range sediments are known for their calcareous deposits containing calcium and magnesium.

On the South Bay Aqueduct, sampling is performed at Check 7, the Santa Clara Terminal Tank, Lake Del Valle, and the release point for Lake Del Valle. With the exception of one sample on the South Bay Aqueduct, all data were below the applicable Article 19 objectives or MCLs for finished drinking water (Figures 3-1 and 3-2). One sample collected at Check 7 on the South Bay Aqueduct contained chloride at 131 mg/L and was above the Monthly Average Article 19 Objective of 110 mg/L. The sample was collected at the end of 1997, when salinity intrusion in the Delta affected mineral levels throughout most of the Project (Figures 3-3 and 3-4).

TDS ranged from 145 to 349 mg/L at Check 7 during 1997 (the only period of sampling) and from 130 to 278 mg/L at the Santa Clara Terminal Tank during 1996-97 (Figure 3-1). Bicarbonate and hardness levels in Del Valle Reservoir and reservoir release samples were consistently higher than those at Check 7 or the Santa Clara Terminal Tank (Figures 3-1 and 3-2). The reverse was true for chloride and sodium. Releases from the reservoir coincided with increases in hardness and decreases in chloride at the Terminal Tank during February to March and September to December, 1996 (Figure 3-4).

Figure 3-1
Conventional Parameters in the North Bay and South Bay Aqueducts, 1996-97

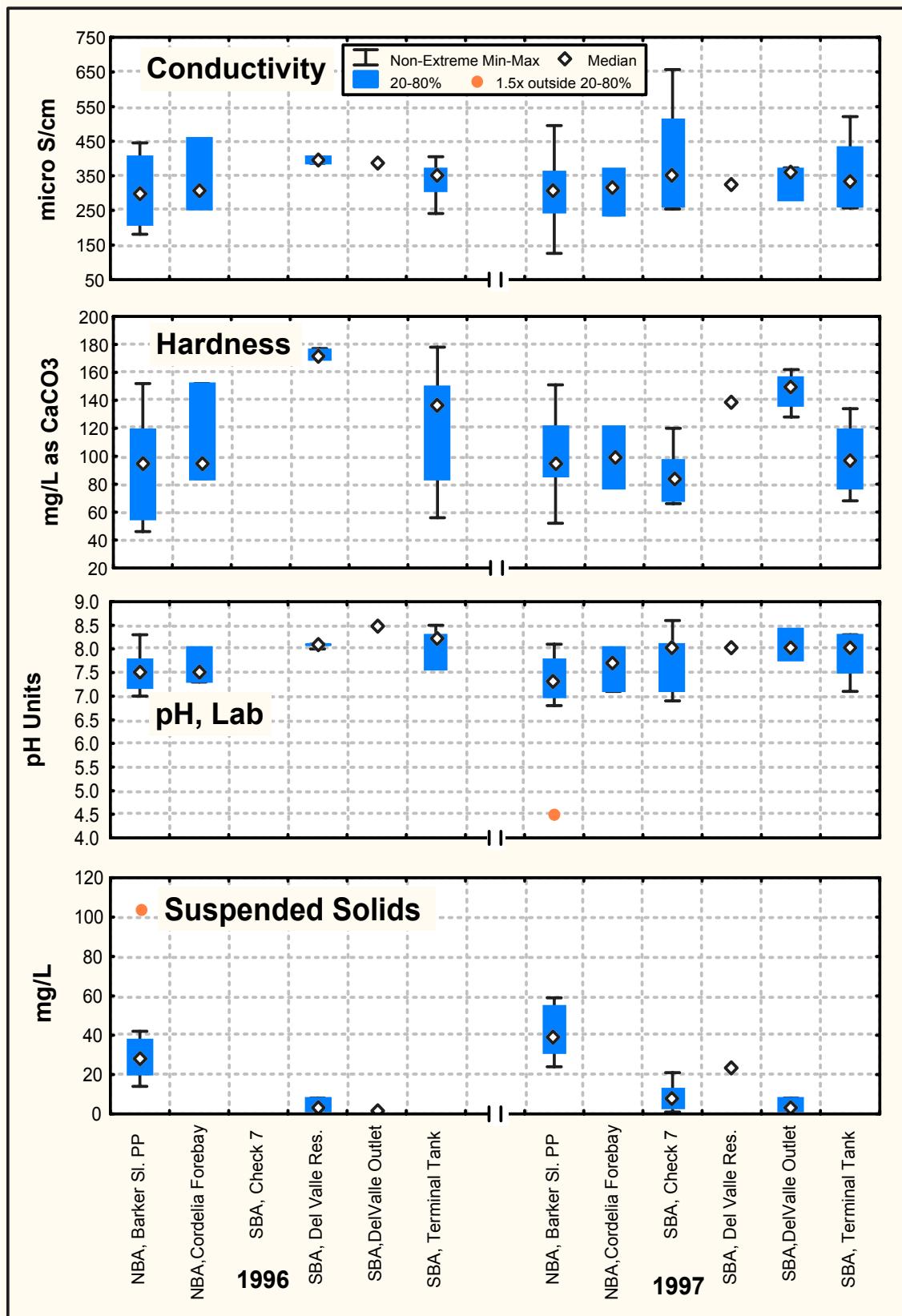


Figure 3-1 (Con't)
Conventional Parameters in the North Bay and South Bay Aqueducts, 1996-97

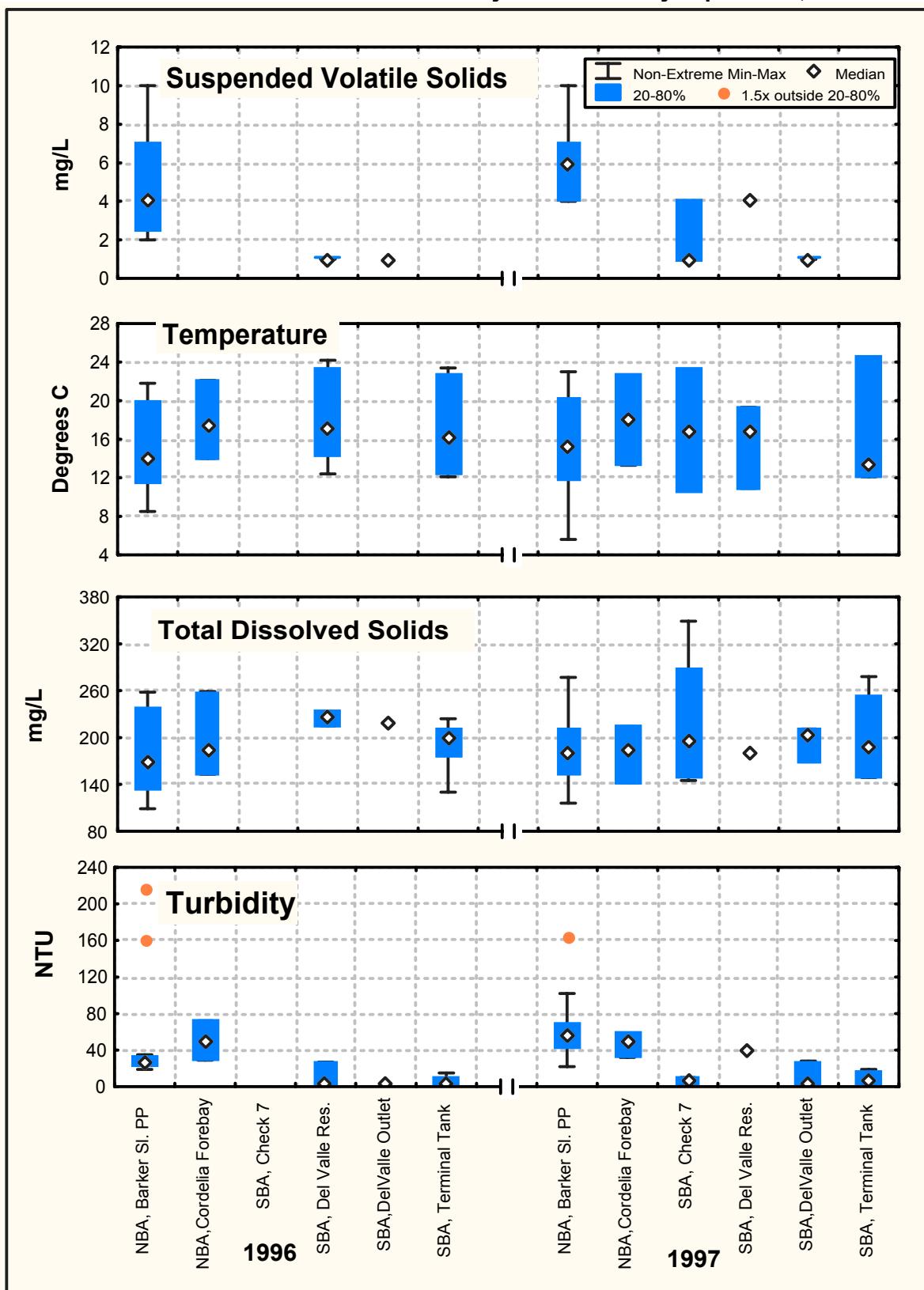


Figure 3-2
Major Minerals in the North Bay and South Bay Aqueducts, 1996-97

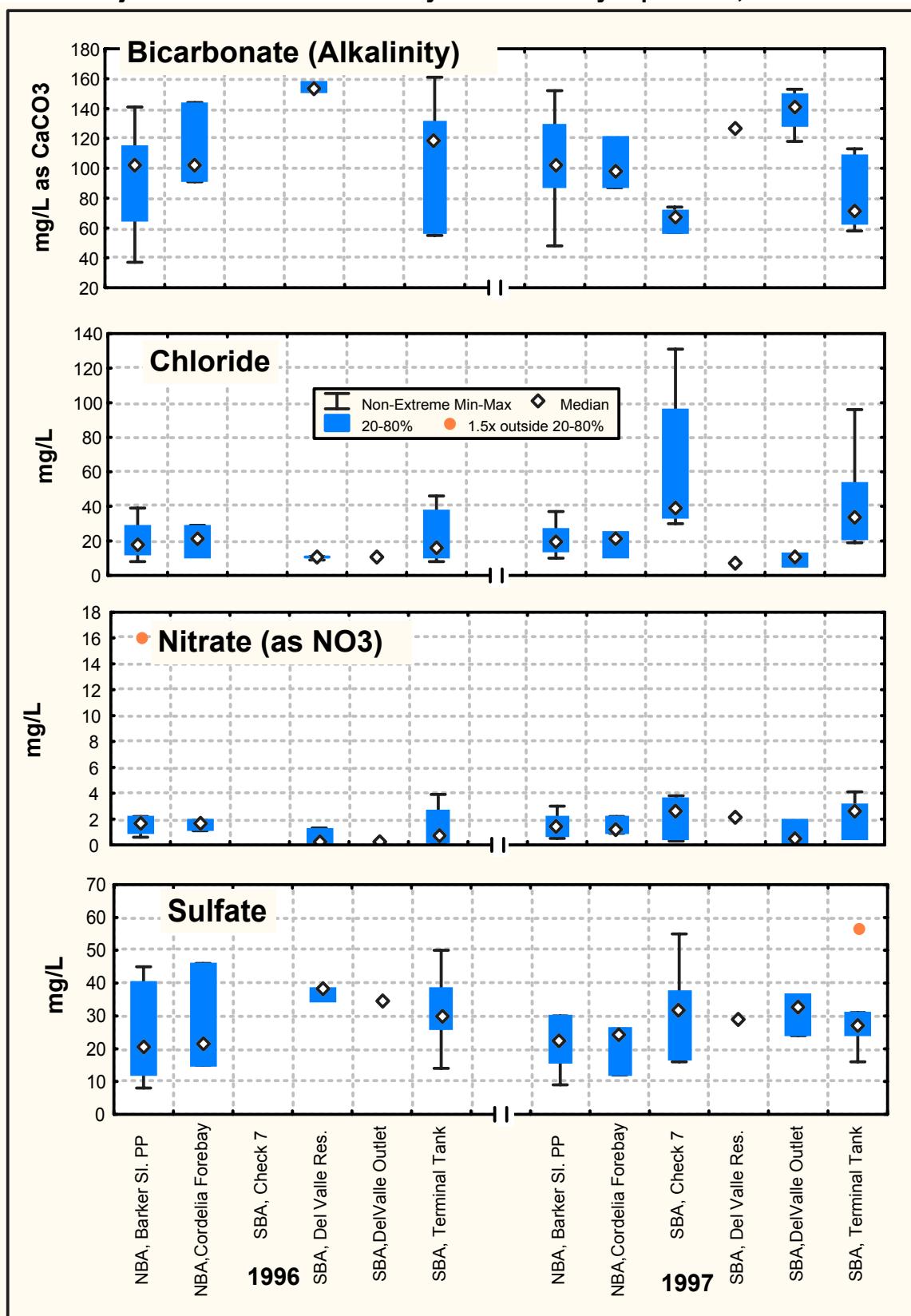


Figure 3-2 (Con't)
Major Minerals in the North Bay and South Bay Aqueducts, 1996-97

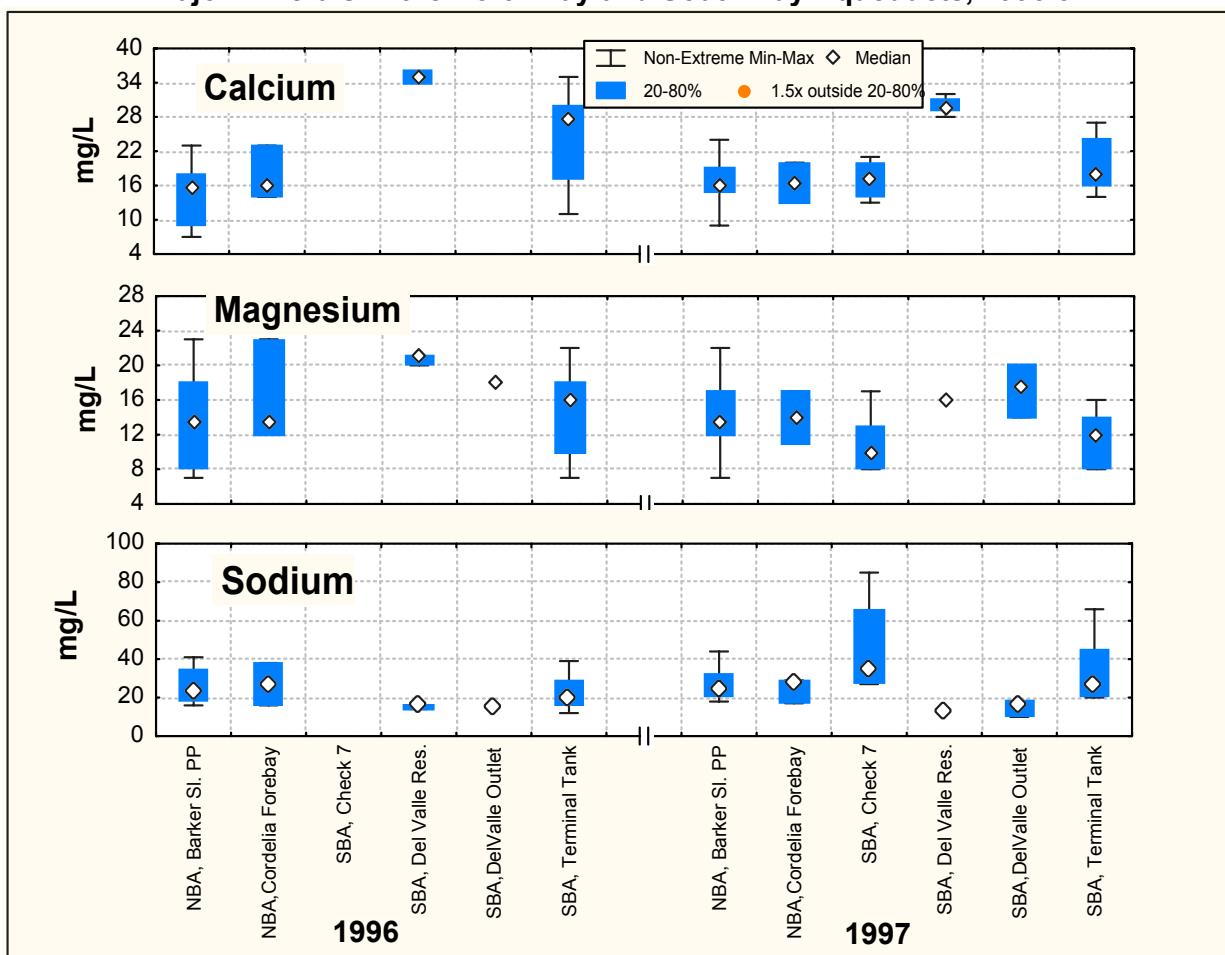


Figure 3-3
Monthly TDS and Turbidity in the North Bay and South Bay Aqueducts

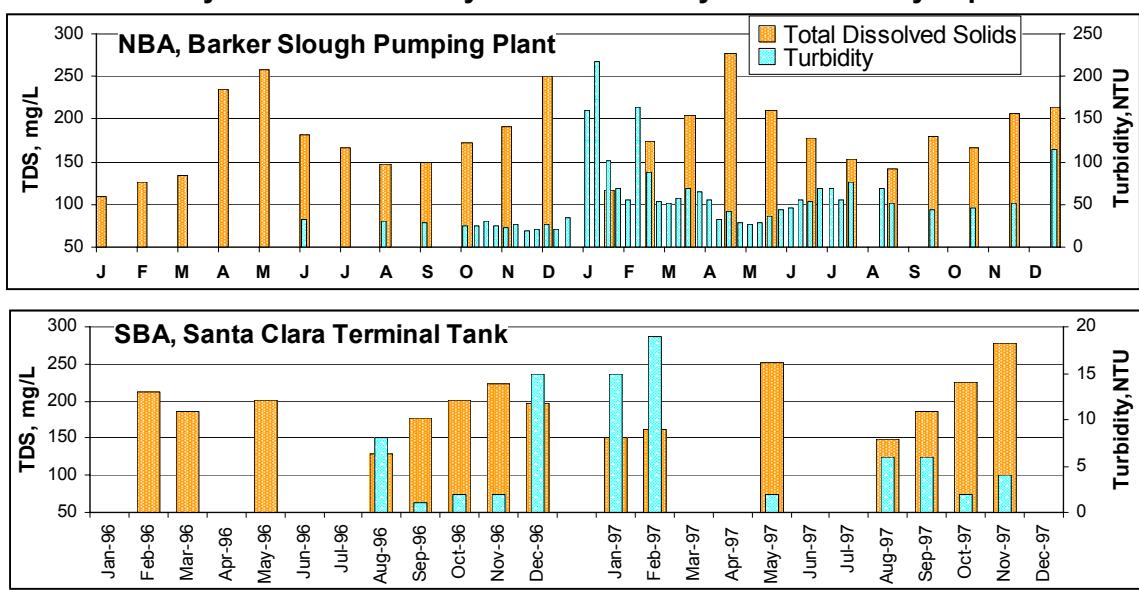
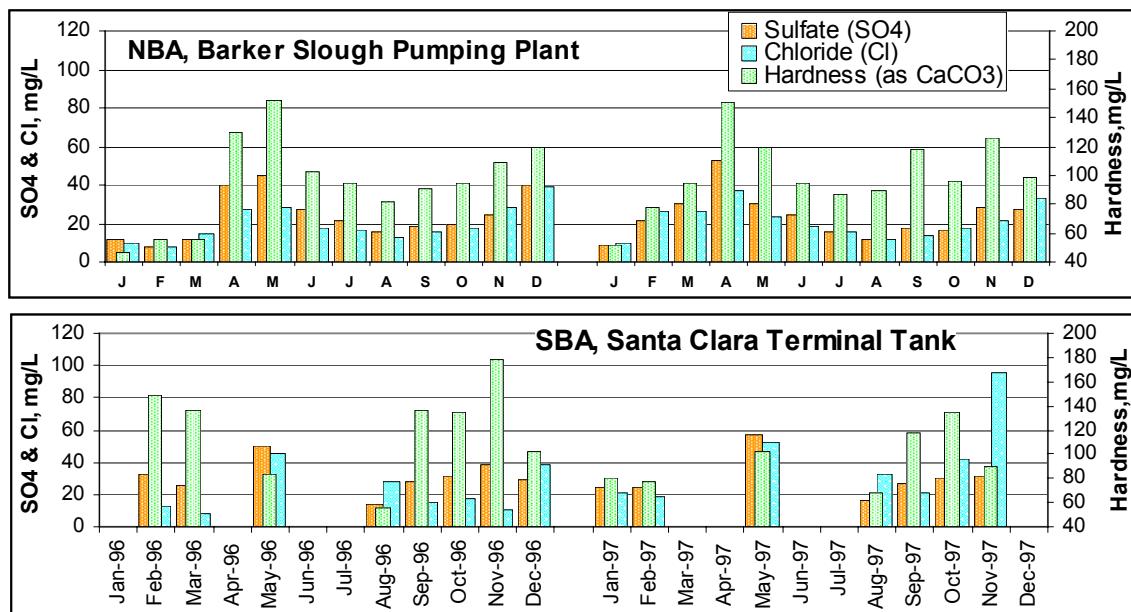


Figure 3-4
Monthly Sulfate, Chloride, and Hardness in the North Bay and South Bay Aqueducts



California Aqueduct and Coastal Branch

With the exception of chloride and sodium, all major minerals and conventional parameters measured in the California Aqueduct and Coastal Branch were below the MCLs for finished drinking water or applicable Article 19 objectives (Figures 3-5 and 3-6). Chloride was detected above the Monthly Average Article 19 Objective of 110 mg/L on several occasions during the end of 1997, when salinity intrusion in the Delta increased mineral concentrations Aqueduct-wide. Sodium levels were also above the Article 19 Objective in the same samples.

TDS was more variable during 1997 than 1996 at most Aqueduct stations, and this variability was largely due to two distinct events. First, TDS (as well as sodium and chloride) increased at the end of 1997 due to salinity intrusion in the Delta (Figures 3-7 and 3-8). Second, some of the lowest mineral concentrations were measured in the Aqueduct during 1997, when Kern River inflows lowered salinity at stations south of Check 29 for about 55 consecutive days in January and February. Kern River inflows are discussed in detail in Special Investigations (Chapter IV).

The median pH increased by about one unit from Banks Pumping Plant to Check 41 during 1996 but varied around 7.5 at both stations in 1997 (Figure 3-5). Coastal Branch pH levels were generally higher than Aqueduct levels possibly due to greater algal growth which can lower the level of bicarbonate—a source of acidity.

Turbidity at all Aqueduct stations fluctuated between one and 48 NTU during both years (Figures 3-5 and 3-7). Turbidity is generally higher at Check 29 because samples are collected from an auto-station circulation system where the intake is situated near the invert (see Appendix A, Methods). Samples at most other stations are collected from between 1 to 9 feet where the particulate concentration in flowing water is usually lower. Turbidity at Check 41 is usually higher than other Aqueduct stations because water in Tehachapi Afterbay is fully mixed.

Figure 3-5
Conventional Parameters in the California Aqueduct and Coastal Branch, 1996-97

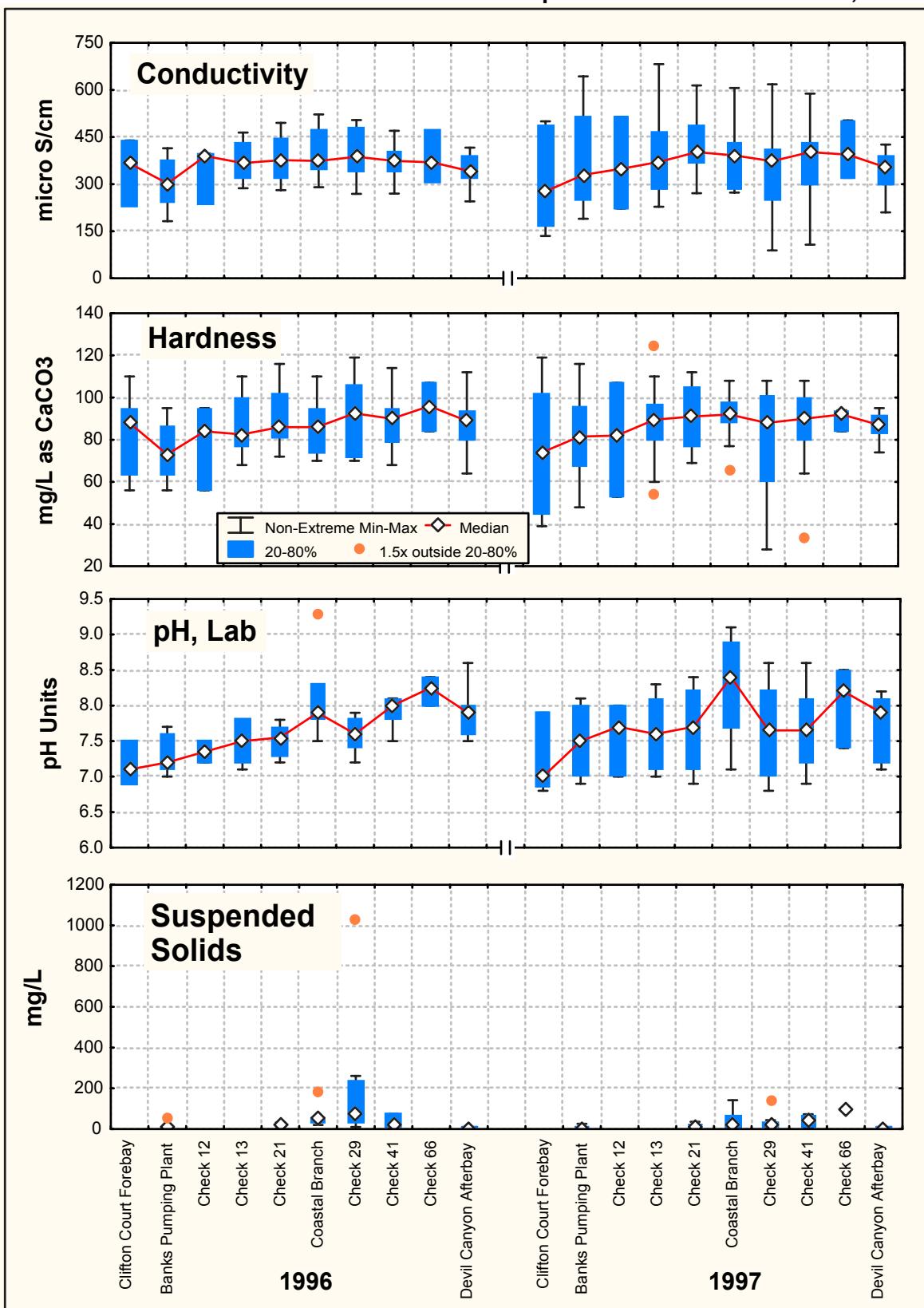


Figure 3-5 (Con't)
Conventional Parameters in the California Aqueduct and Coastal Branch, 1996-97

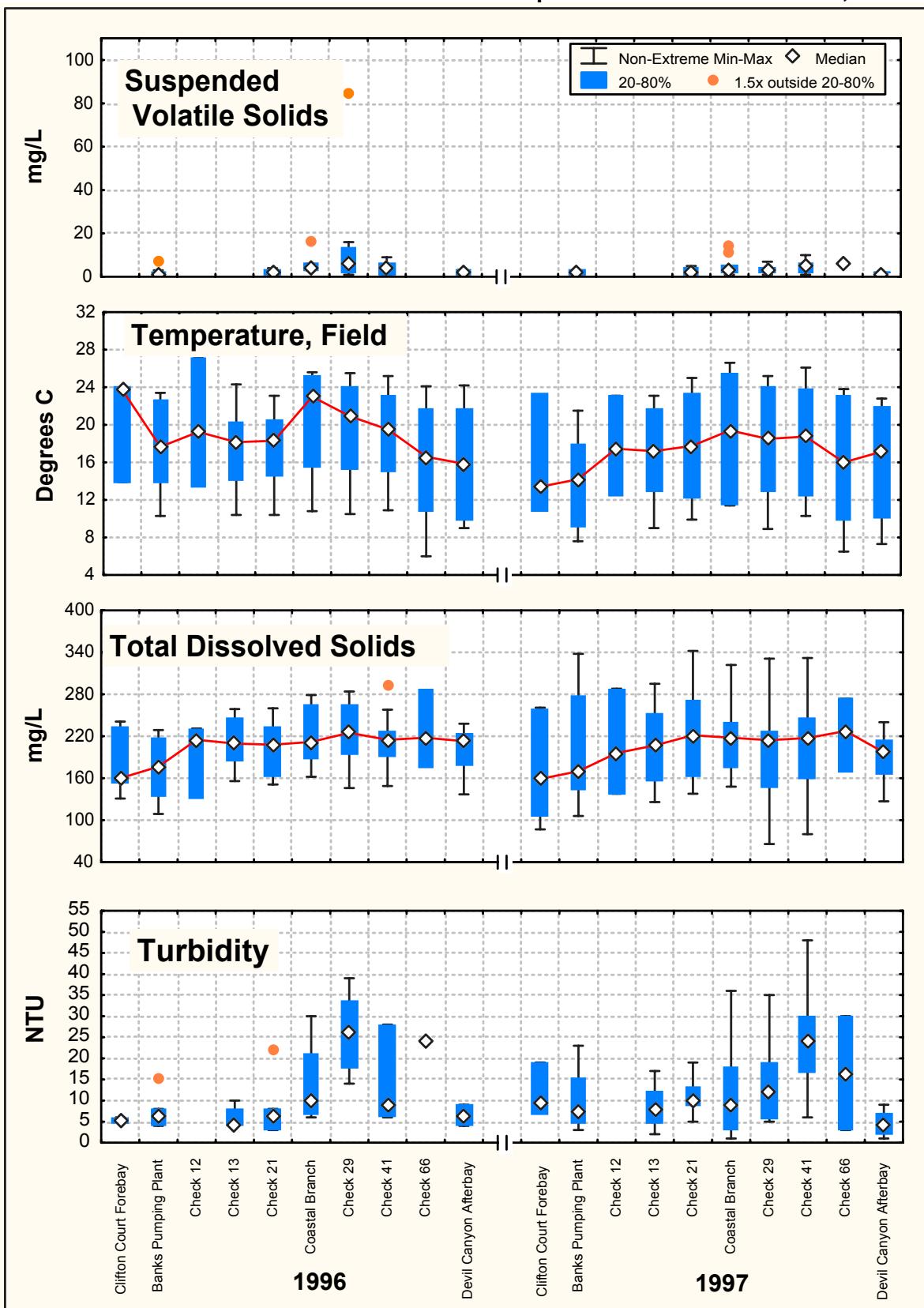


Figure 3-6
Major Minerals in the California Aqueduct and Coastal Branch, 1996-97

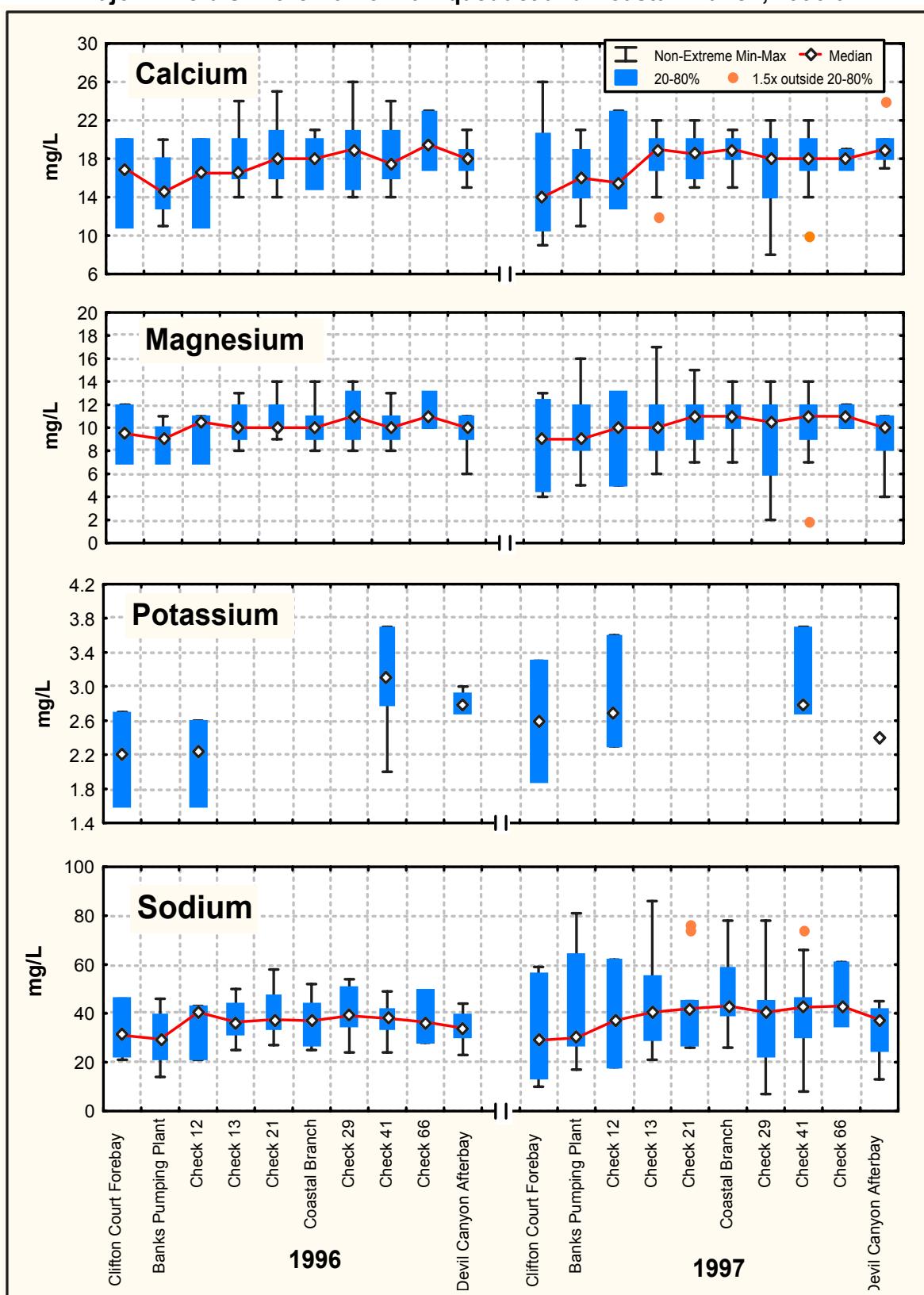


Figure 3-6 (Con't)
Major Minerals in the California Aqueduct and Coastal Branch, 1996-97

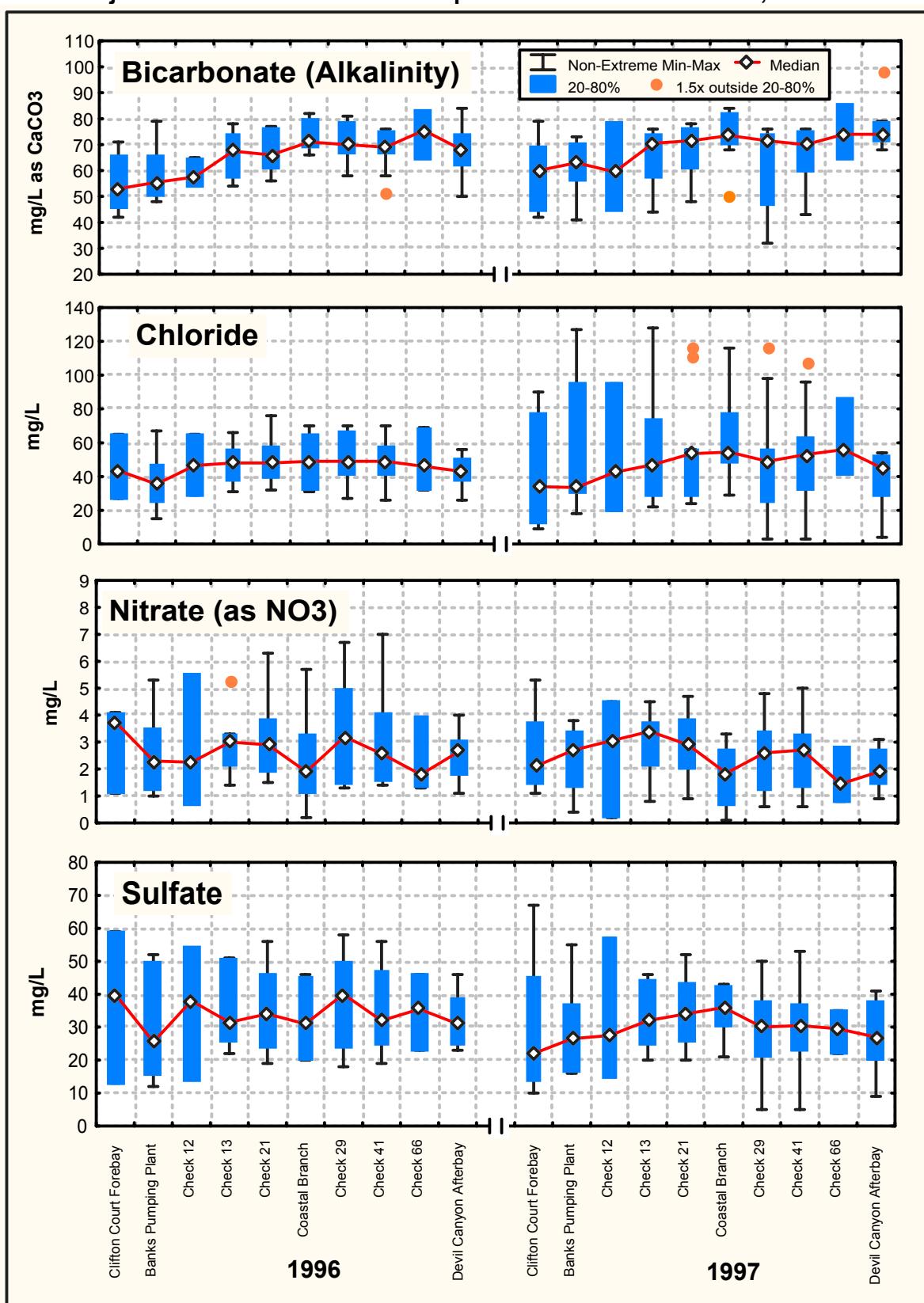


Figure 3-7
Monthly TDS and Turbidity in the California Aqueduct

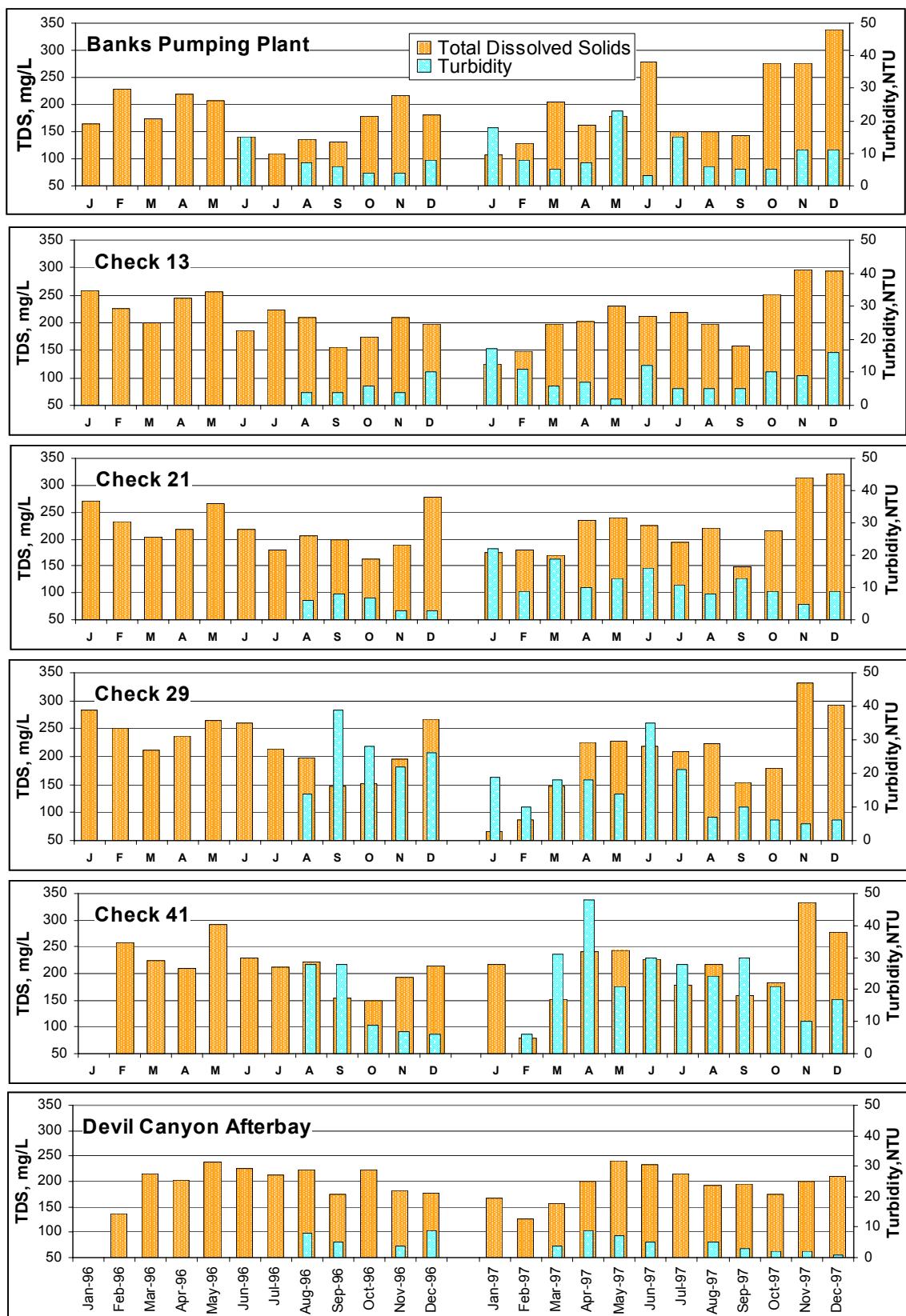
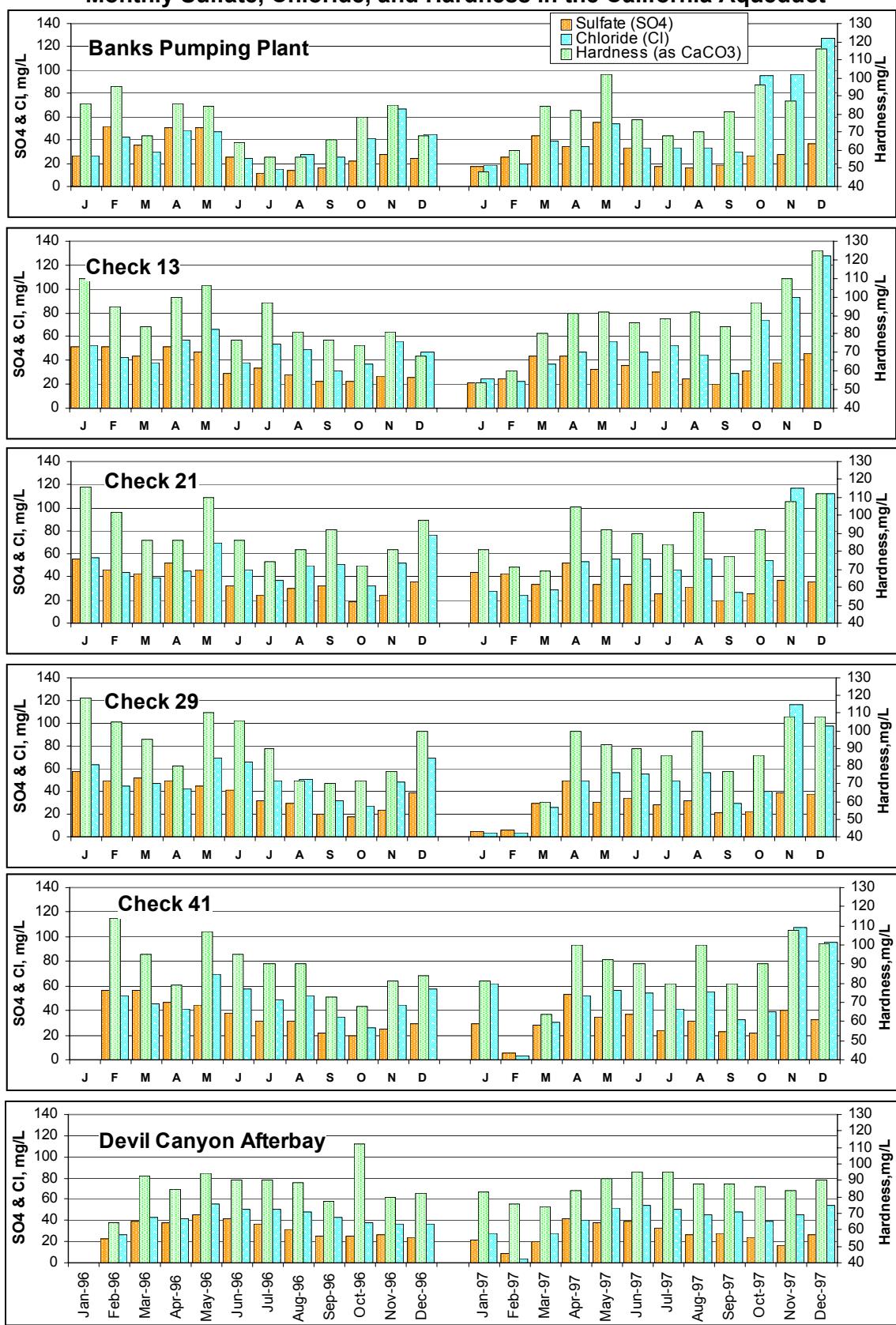


Figure 3-8
Monthly Sulfate, Chloride, and Hardness in the California Aqueduct



San Luis Reservoir and Southern California Lakes

Conventional parameters and major minerals measured in San Luis Reservoir during 1996-97 were below all MCLs for finished drinking water or applicable Article 19 objectives (Tables 3-2 and 3-3). TDS declined from an average of 263 mg/L in 1996 (range 216 to 281 mg/L) to 227 mg/L in 1997 (range 194 to 257 mg/L). Monthly TDS was relatively constant in 1996 until October when concentrations began declining (Figure 3-9). A similar decline was observed for hardness, sulfate, and chloride (Figure 3-10) and was related to reservoir filling (from Delta pumping) that started in September and continued into 1997. Salinity has been steadily decreasing in the reservoir since 1993—the end of the 1987-92 drought (DWR, *Effects of Water Operations on Water Quality in the California Aqueduct*, in preparation).

Table 3-2
Conventional Parameters in San Luis Reservoir and Southern California Lakes, 1996-97

Parameter	Station Name	I.D. #	1996			1997			# of Samples		
			Mean	Low	High	# of Samples			Mean	Low	High
						Mean	Low	High			
Conductivity (Specific Conductance) µS/cm	San Luis Reservoir	SL001000	470	409	501	12	407	363	456	12	
	Pyramid Lake	PY001000	457	414	539	4	416	401	427	4	
	Castaic Lake	CA002000	599	560	627	4	516	480	540	4	
	Silverwood Lake	SI002000	364	322	408	4	337	242	399	4	
	Lake Perris	PE002000	693	663	712	4	633	609	660	4	
Hardness mg/L as CaCO ₃	San Luis Reservoir	SL005000	106	92	113	12	95	90	123	12	
	Pyramid Lake	PY001000	127	112	160	4	109	100	115	4	
	Castaic Lake	CA002000	181	161	192	4	150	138	161	4	
	Silverwood Lake	SI002000	90	84	94	4	88	84	91	4	
	Lake Perris	PE002000	143	135	148	4	138	131	147	4	
pH, Lab	San Luis Reservoir	SL001000	8.3	6.9	9.2	11	8.5	7.8	9.1	12	
	Pyramid Lake	PY001000	8.3	8.0	9.2	12	8.2	7.9	8.9	11	
	Castaic Lake	CA002000	8.6	8.0	9.2	12	8.5	8.0	9.2	12	
	Silverwood Lake	SI002000	8.1	7.7	8.9	11	8.1	7.2	8.5	9	
	Lake Perris	PE002000	8.6	7.9	9.1	11	8.4	7.9	9.1	12	
Temperature Degrees C	San Luis Reservoir	SL001000	19	14	23	11	19	13	27	12	
	Pyramid Lake	PY001000	18	12	24	12	18	11	24	11	
	Castaic Lake	CA002000	19	14	26	12	19	13	25	12	
	Silverwood Lake	SI002000	17	9	24	11	16	7	22	9	
	Lake Perris	PE002000	21	14	28	11	20	12	27	12	
Total Dissolved Solids mg/L	San Luis Reservoir	SL001000	263	216	281	12	227	194	257	12	
	Pyramid Lake	PY001000	277	233	339	4	236	232	240	4	
	Castaic Lake	CA002000	378	331	406	4	308	279	325	4	
	Silverwood Lake	SI002000	215	187	246	4	198	152	234	4	
	Lake Perris	PE002000	390	360	405	4	352	340	370	4	
Turbidity NTU	San Luis Reservoir	SL001000	2	<1	4	12	3	<1	12	12	
	Pyramid Lake	PY001000	2	10	2	2	2	<1	2	4	
	Castaic Lake	CA002000	<1	2	2	2	2	<1	3	4	
	Silverwood Lake	SI002000	4	6	2	2	4	<1	7	3	
	Lake Perris	PE002000	<1	<1	2	2	2	<1	4	3	

Monitoring for conventional parameters and major minerals at Pyramid, Castaic, and Silverwood lakes and Lake Perris is conducted quarterly. Except for hardness, chloride, and sodium, all data were below the MCLs for finished drinking water or applicable Article 19 objectives (Tables 3-2 and 3-3). Hardness was above the Monthly Average Article 19 Objective of 180 mg/L twice in 1996 at Castaic Lake. Chloride and sodium in Lake Perris were above their respective Article 19 objectives on several occasions in 1996.

TDS, sulfate, and hardness declined steadily throughout 1996 at Pyramid lake but remained somewhat constant during 1997 (Figures 3-9 and 3-10). The higher TDS levels in early 1996 were due to inflows from Piru Creek that were unusually high the previous year. Piru Creek is elevated in TDS from ancient marine sediments in the watershed and these inflows contribute substantially to Pyramid Lake's salinity.

Table 3-3
Major Minerals in San Luis Reservoir and Southern California Lakes, 1996-97

Parameter	Station Name	I.D. #	1996			1997			# of Samples		
			Mean	Low	High	# of Samples	Mean	Low	High	# of Samples	
Calcium mg/L	San Luis Reservoir	SL001000	21	19	23	12	20	18	26	12	
	Pyramid Lake	PY001000	29	25	37	4	24	22	26	4	
	Castaic Lake	CA002000	42	38	45	4	35	32	38	4	
	Silverwood Lake	SI002000	19	17	20	4	21	17	26	4	
	Lake Perris	PE002000	27	26	28	4	27	26	29	4	
Magnesium mg/L	San Luis Reservoir	SL001000	13	11	14	12	11	11	14	12	
	Pyramid Lake	PY001000	14	12	16	4	12	11	12	4	
	Castaic Lake	CA002000	18	16	19	4	15	14	16	4	
	Silverwood Lake	SI002000	11	10	11	4	9	6	10	4	
	Lake Perris	PE002000	19	17	20	4	17	16	18	4	
Potassium mg/L	San Luis Reservoir	SL001000									
	Pyramid Lake	PY001000	3.0	2.9	3.1	3					
	Castaic Lake	CA002000	3.6	3.4	3.7	3					
	Silverwood Lake	SI002000	2.7	2.6	2.8	3					
	Lake Perris	PE002000	4.9	4.9	5.0	3					
Sodium mg/L	San Luis Reservoir	SL001000	50	42	56	12	44	39	52	12	
	Pyramid Lake	PY001000	42	38	47	4	41	39	43	4	
	Castaic Lake	CA002000	52	49	54	4	47	45	50	4	
	Silverwood Lake	SI002000	37	31	43	4	32	12	42	4	
	Lake Perris	PE002000	83	78	88	4	76	70	80	4	
Bicarbonate mg/L as CaCO ₃	San Luis Reservoir	SL001000	79	76	84	12	76	73	89	12	
	Pyramid Lake	PY001000	83	75	93	4	81	77	86	4	
	Castaic Lake	CA002000	100	97	104	4	95	85	107	4	
	Silverwood Lake	SI002000	69	66	74	4	79	68	97	4	
	Lake Perris	PE002000	107	104	108	4	108	101	120	4	
Chloride mg/L	San Luis Reservoir	SL001000	70	55	78	12	57	48	70	12	
	Pyramid Lake	PY001000	46	43	49	4	46	42	52	4	
	Castaic Lake	CA002000	52	50	54	4	45	43	48	4	
	Silverwood Lake	SI002000	45	38	55	4	45	10	52	4	
	Lake Perris	PE002000	114	102	121	4	96	91	109	4	
Nitrate mg/L as NO ₃	San Luis Reservoir	SL001000	3.1	2.1	4.0	12	2.3	0.2	3.9	12	
	Pyramid Lake	PY001000	1.5	0.2	2.5	4	2.2	1.8	2.5	4	
	Castaic Lake	CA002000	0.7	<0.1	1.3	4	0.8	<0.1	1.8	4	
	Silverwood Lake	SI002000	2.0	1.1	2.3	4	2.3	1.6	3.5	4	
	Lake Perris	PE002000	0.1	<0.1	0.1	4	0.3	<0.1	0.6	4	
Sulfate mg/L	San Luis Reservoir	SL001000	41	33	45	12	32	27	35	12	
	Pyramid Lake	PY001000	74	55	107	4	51	45	57	4	
	Castaic Lake	CA002000	121	102	129	4	89	78	98	4	
	Silverwood Lake	SI002000	36	25	48	4	26	11	40	4	
	Lake Perris	PE002000	56	40	64	4	56	53	60	4	

Chloride did not exhibit similar trends because Piru Creek contains very little chloride compared to Project inflows (Figure 3-10) (see Special Investigations, Chapter IV). At Silverwood Lake, chloride and sulfate were lowest in February 1997, when Kern River inflows influenced water quality in the lake (Figure 3-10).

Sodium and chloride were highest in Lake Perris. Chloride levels at Lake Perris ranged from 91 to 121 mg/L during 1996-97, while levels at all other lakes ranged between 43 and 52 mg/L (Table 3-3). The higher levels are likely the result of simple evaporation, since local inflows are minimal.

Figure 3-9
Monthly TDS and Turbidity in San Luis Reservoir and Southern California Lakes

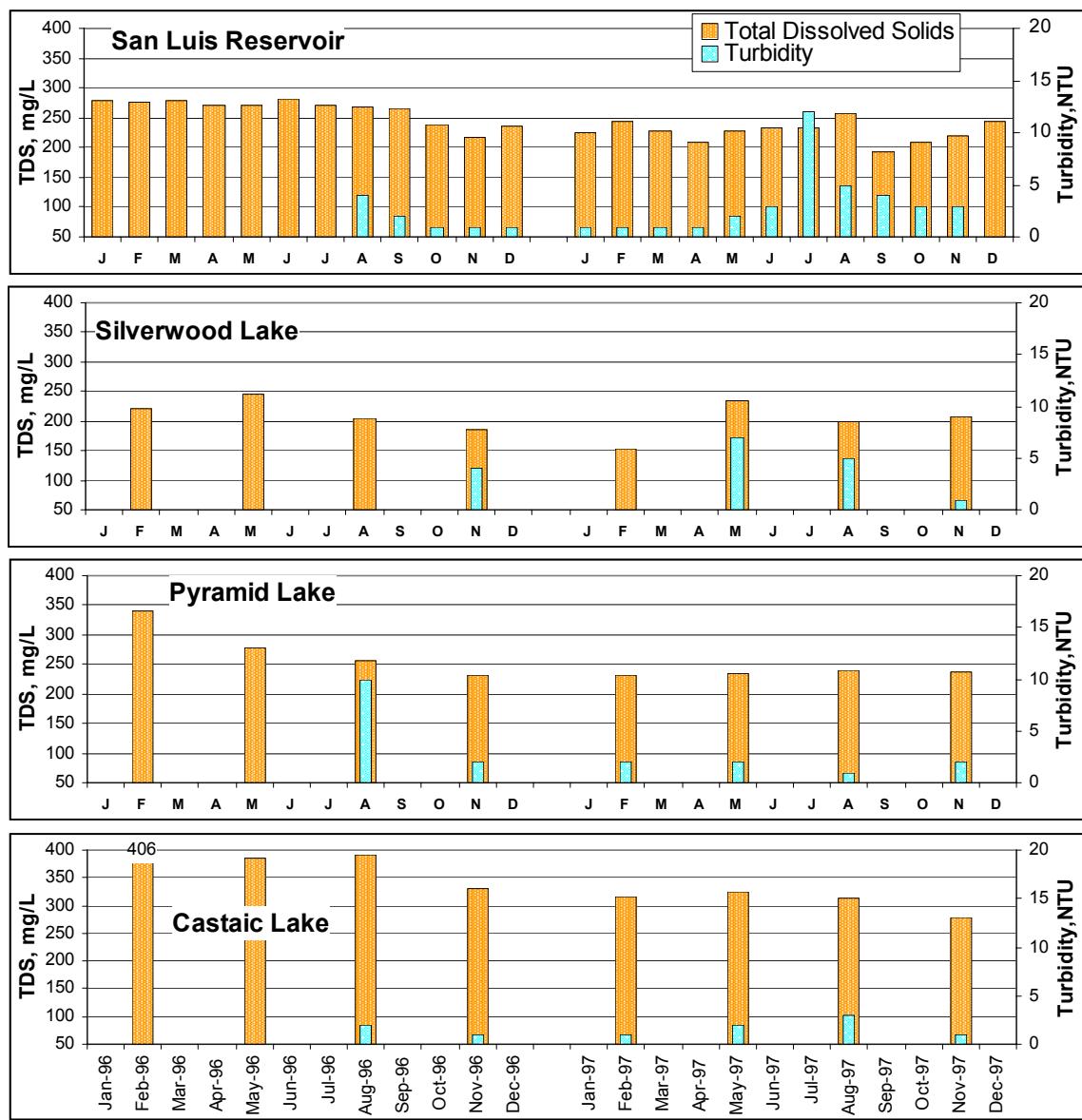
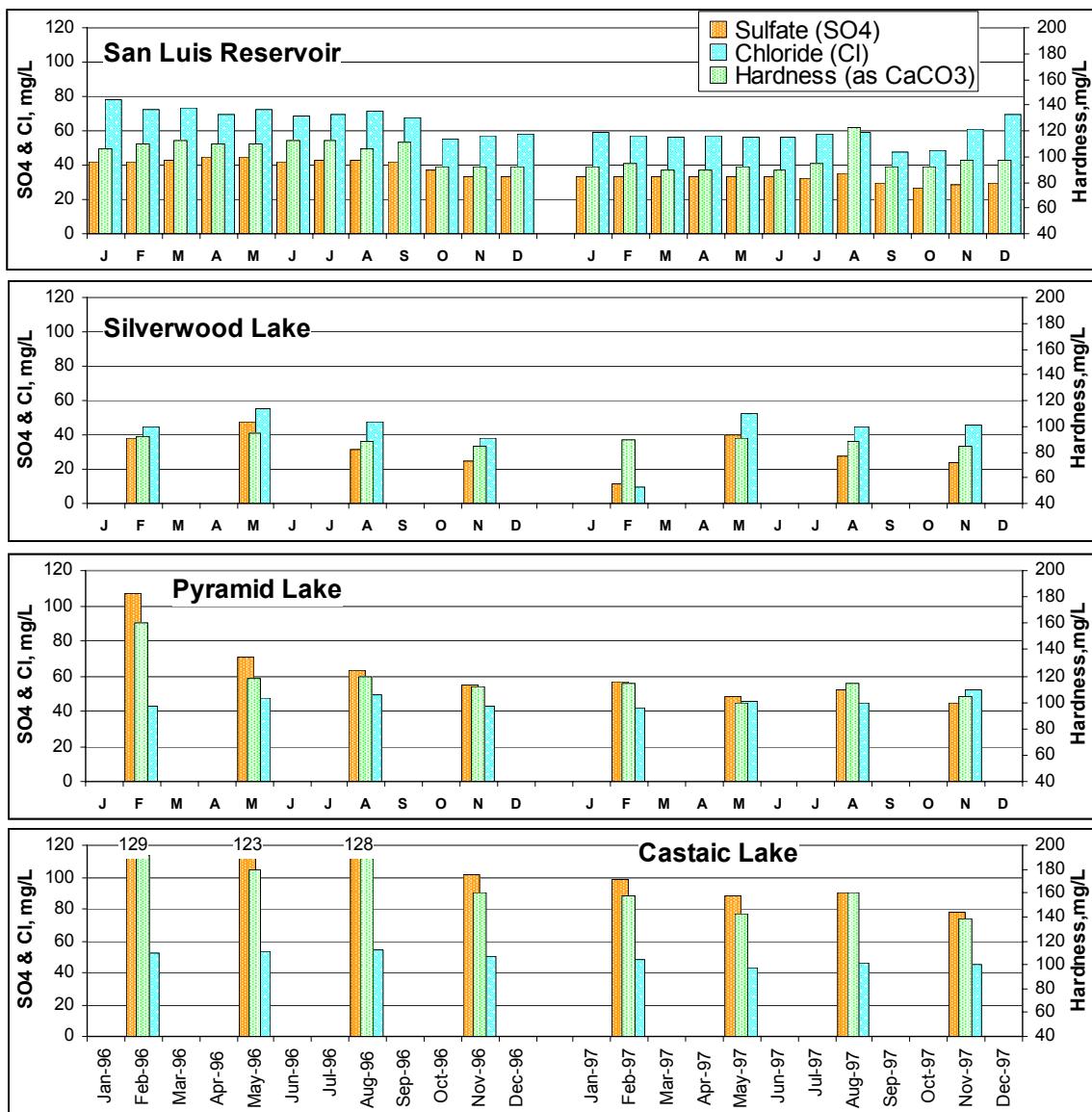


Figure 3-10
Monthly Sulfate, Chloride, and Hardness in San Luis Reservoir and Southern California Lakes



Minor Elements

Minor elements include metals such as copper, zinc, and iron, and non-metals such as arsenic and selenium. They are called minor elements because concentrations are usually below 1 part per million in natural surface waters. Existing MCLs and Article 19 objectives for these parameters are presented in Appendix B, Table B-2.

Feather River Watershed

Minor elements at Project stations in the Feather River Watershed during 1996-97 were below detection except for iron, manganese, aluminum, barium, and copper (Table 3-4). Iron was detected at 0.36 mg/L in one sample from Lake Davis and exceeded the MCL for finished drinking water of 0.3 mg/L. Manganese was also elevated in that sample at 0.819 mg/L, indicating the possibility of sample contamination.

Table 3-4
Minor Element Concentrations in the Feather River Watershed, 1996-97 (mg/L)

Parameter	Station Name	I.D. #	1996			1997			# of Samples
			Median	Low	High	# of Samples	Median	Low	
Aluminum	Thermalito Forebay	TF001000	< 0.010			1	< 0.010	< 0.010	3
	Thermalito Afterbay	TA001000		< 0.010	< 0.010	3	0.011	< 0.010	4
Cadmium	Thermalito Forebay	TF001000		< 0.005	< 0.005	4		< 0.001	3
	Thermalito Afterbay	TA001000		< 0.005	< 0.005	3		< 0.001	2
Copper	Antelope Lake	AN001000	< 0.005			1	< 0.005		1
	Frenchman Lake	FR001000	< 0.005			1	< 0.005		1
	Lake Davis	LD001000	< 0.005			1	< 0.005		1
	Thermalito Forebay	TF001000	< 0.005	< 0.005	< 0.005	3	< 0.001	< 0.001	4
	Thermalito Afterbay	TA001000	< 0.005	< 0.005	< 0.005	11	< 0.005	< 0.005	12
Chromium	Antelope Lake	AN001000	< 0.005			1	< 0.005		1
	Frenchman Lake	FR001000	< 0.005			1	< 0.005		1
	Lake Davis	LD001000	< 0.005			1	< 0.005		1
	Thermalito Forebay	TF001000		< 0.005	< 0.005	3		< 0.005	4
	Thermalito Afterbay	TA001000		< 0.005	< 0.005	11		< 0.005	12
Iron	Antelope Lake	AN001000	0.120			1	0.183		1
	Frenchman Lake	FR001000	0.026			1	0.067		1
	Lake Davis	LD001000	0.086	0.015	0.362	5	0.044	0.006	5
	Thermalito Forebay	TF001000	0.011	0.007	0.013	3	0.010	< 0.005	4
	Thermalito Afterbay	TA001000	0.009	0.005	0.021	11	0.008	< 0.005	12
Lead	Antelope Lake	AN001000	< 0.005			1	< 0.005		1
	Frenchman Lake	FR001000	< 0.005			1	< 0.005		1
	Lake Davis	LD001000	< 0.005			1	< 0.005		1
	Thermalito Forebay	TF001000	< 0.005	< 0.005	< 0.005	3	< 0.001	< 0.001	4
	Thermalito Afterbay	TA001000	< 0.005	< 0.005	< 0.005	11	< 0.001	< 0.001	12
Manganese	Antelope Lake	AN001000	0.006			1	0.013		1
	Frenchman Lake	FR001000	< 0.005			1	< 0.005		1
	Lake Davis	LD001000	0.113	< 0.005	0.819	5	0.114	< 0.005	5
	Thermalito Forebay	TF001000	< 0.005	< 0.005	< 0.005	3	< 0.005	< 0.005	4
	Thermalito Afterbay	TA001000	0.005	< 0.005	0.006	11	0.006	< 0.005	12
Mercury	Thermalito Forebay	TF001000		< 0.001	< 0.001	3		< 0.0002	4
	Thermalito Afterbay	TA001000		< 0.001	< 0.001	2		< 0.0002	3
Silver	Thermalito Forebay	TF001000	< 0.005	< 0.005	< 0.005	3	< 0.001	< 0.001	4
	Thermalito Afterbay	TA001000	< 0.005	< 0.005	< 0.005	2	< 0.001	< 0.001	3
Zinc	Antelope Lake	AN001000	< 0.005			1	< 0.005		1
	Frenchman Lake	FR001000	< 0.005			1	< 0.005		1
	Lake Davis	LD001000	< 0.005			1	< 0.005		1
	Thermalito Forebay	TF001000	< 0.005	< 0.005	< 0.005	3	< 0.005	< 0.005	4
	Thermalito Afterbay	TA001000	< 0.005	< 0.005	< 0.005	11	< 0.005	< 0.005	12
Arsenic	Antelope Lake	AN001000	< 0.001			1	< 0.001		1
	Frenchman Lake	FR001000	< 0.001			1	< 0.001		1
	Lake Davis	LD001000	< 0.001			1	< 0.001		1
	Thermalito Forebay	TF001000		< 0.001	< 0.001	3		< 0.001	4
	Thermalito Afterbay	TA001000		< 0.001	< 0.001	11		< 0.001	12
Barium	Thermalito Forebay	TA001000	< 0.05	< 0.05	0.05	4		< 0.05	5
	Thermalito Afterbay	TF001000		< 0.05	< 0.05	3		< 0.05	4
Boron	Antelope Lake	AN001000	< 0.1			1	< 0.1		1
	Frenchman Lake	FR001000	< 0.1			1	< 0.1		1
	Lake Davis	LD001000	< 0.1			1	< 0.1		1
	Thermalito Forebay	TF001000		< 0.1	< 0.1	3		< 0.1	4
	Thermalito Afterbay	TA001000		< 0.1	< 0.1	11		< 0.1	12
Bromide	Thermalito Forebay	TA001000	< 0.010			1			
	Thermalito Afterbay	TF001000		< 0.010	< 0.010	3		< 0.010	4
Fluoride	Antelope Lake	AN001000	< 0.1			1	< 0.1		1
	Frenchman Lake	FR001000	< 0.1			1	< 0.1		1
	Lake Davis	LD001000	< 0.1			1	< 0.1		1
	Thermalito Forebay	TF001000		< 0.1	< 0.1	3		< 0.1	4
	Thermalito Afterbay	TA001000		< 0.1	< 0.1	11		< 0.1	12
Selenium	Antelope Lake	AN001000	< 0.001			1	< 0.001		1
	Frenchman Lake	FR001000	< 0.001			1	< 0.001		1
	Lake Davis	LD001000	< 0.001			1	< 0.001		1
	Thermalito Forebay	TF001000		< 0.001	< 0.001	3		< 0.001	4
	Thermalito Afterbay	TA001000		< 0.001	< 0.001	11		< 0.001	12

Although both iron and manganese are naturally present in Lake Davis, all other iron concentrations were below 0.1 mg/L. Copper was detected at four times above the reporting limit of <0.001 mg/L in Thermalito Afterbay during 1997. Aluminum and barium were detected once each at Thermalito Afterbay and Forebay, respectively.

North Bay and South Bay Aqueducts

In the North Bay Aqueduct, cadmium, lead, mercury, and silver were below their respective reporting limits during 1996-97 (Table 3-5). All minor elements except iron and manganese were below the MCLs for finished drinking water or Article 19 objectives. At Barker Slough Pumping Plant, one sample contained iron at 0.517 mg/L, which was collected near the end of December 1996 when rainfall runoff from the upstream watershed dropped the pH to 6.3 (Figure 3-11). As pH decreases, metals solubility increases dramatically and more of the “total” fraction of iron becomes dissolved. Aluminum and manganese were also elevated in the same sample at 0.44 mg/L and 0.36 mg/L, respectively. Similar trends were observed in the past at this station and are detailed in Special Investigations (Chapter IV). In March 1997, the pH dropped to 4.5, but there was no substantial increase in iron or manganese (see Conventional Parameters and Major Minerals for further discussion) (Figure 3-11).

Similar to minerals, bromide began increasing at the start of each year, peaked in April or May, then declined throughout the summer (Figure 3-11). This indicates an influence from groundwater, since accretion into Barker Slough would be greatest after the rainy season. Another indicator of groundwater influence is the higher spring pH levels. Bromide was mostly below 0.1 mg/L at Barker Slough Pumping Plant, with the exception of one sample in October 1997 that contained 0.2 mg/L (Table 3-6). The higher bromide value might indicate salinity intrusion from the Delta, but a corresponding increase in TDS was not observed.

In the South Bay Aqueduct, aluminum, lead, mercury, and silver were below their respective reporting limits at all stations monitored during 1996-97 (Table 3-5). Other metallic elements were infrequently detected and all positives were below the MCLs for finished drinking water or Article 19 objectives. The copper values for the South Bay Aqueduct were, at times, biased due to copper sulfate treatments for algae control.

Zinc levels in Del Valle Reservoir were unusually elevated. Concentrations ranged from 0.025 to 0.437 mg/L in 1996 and from <0.05 to 0.232 mg/L in 1997. Although the values were well below the Secondary MCL of 5.0 mg/L for finished drinking water, they were the highest measured in the Project. Routinely high levels would suggest that sample contamination was not the source of the elevated zinc.

Historically, zinc has been higher in Del Valle Reservoir compared to other Project stations, but never over 0.1 mg/L. Although during a 4-month period in 1997, zinc contamination from the lab raised the reporting limit to <0.05 mg/L, it was well below levels in the reservoir.

A possible source of zinc in Del Valle Reservoir is an abandoned mine that was inundated when the lake was filled. At a nearby abandoned mine—Mount Diablo—zinc has been detected at elevated levels in its adit discharge. The mine is located about 20 miles north of Del Valle Reservoir, and the two regions may share the same geological characteristics. Barium levels were also routinely above the reporting limit and may be an indicator of the source or sources (Table 3-6). Further work is needed to determine if zinc is naturally present in Del Valle Reservoir.

Most nonmetallic elements in the South Bay Aqueduct were near or below their reporting limits, and none were above the MCLs for finished drinking water or Article 19 objectives (Table 3-6). The maximum bromide level at Santa Clara Terminal Tank was 0.13 mg/L in 1996 and 0.35 mg/L in 1997.

Table 3-5
Metallic Element Concentrations in the North Bay and
South Bay Aqueducts, 1996-97 (mg/L)

Parameter	Station Name	I.D#	1996			1997			# of Samples	
			Median	Low	High	# of Samples	Median	Low		
Aluminum	NBA, Barker Sl. Pumping Plant	KG000000	< 0.010	< 0.010	0.438	23	< 0.010	< 0.010	0.022	33
	NBA, Cordelia Forebay	KG002111		< 0.010	< 0.010	4		< 0.010	< 0.010	4
	SBA, Check 7	KB001638						< 0.010	< 0.010	9
	SBA, Del Valle Reservoir	DV001000		< 0.010	< 0.010	3	< 0.010			1
	SBA, Del Valle Outlet	DV000000	< 0.010			1		< 0.010	< 0.010	5
	SBA, Santa Clara Terminal Tank	KB004207		< 0.005	< 0.010	8	< 0.010	< 0.010	< 0.010	7
Cadmium	NBA, Barker Sl. Pumping Plant	KG000000		< 0.005	< 0.005	12	< 0.001	< 0.001	< 0.005	12
	NBA, Cordelia Forebay	KG002111		< 0.005	< 0.005	4	< 0.001	< 0.001	< 0.001	4
	SBA, Check 7	KB001638					< 0.001	< 0.001	< 0.005	9
	SBA, Del Valle Reservoir	DV001000		< 0.005	< 0.005	3	< 0.005			1
	SBA, Del Valle Outlet	DV000000	< 0.005			1	< 0.001	< 0.001	< 0.005	4
	SBA, Santa Clara Terminal Tank	KB004207		< 0.005	< 0.005	8	< 0.001	< 0.001	< 0.005	7
Copper	NBA, Barker Sl. Pumping Plant	KG000000		< 0.005	< 0.005	12	< 0.005	< 0.005	0.004	12
	NBA, Cordelia Forebay	KG002111	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	0.002	4
	SBA, Check 7	KB001638					0.003	< 0.005	0.015	9
	SBA, Del Valle Reservoir	DV001000		< 0.005	< 0.005	3	< 0.005			1
	SBA, Del Valle Outlet	DV000000	< 0.005			1	< 0.005	< 0.005	0.002	4
	SBA, Santa Clara Terminal Tank	KB004207	< 0.005	< 0.005	0.039	8	< 0.005	< 0.005	0.003	7
Chromium	NBA, Barker Sl. Pumping Plant	KG000000		< 0.005	< 0.005	12	< 0.005	< 0.005	0.007	12
	NBA, Cordelia Forebay	KG002111		< 0.005	< 0.005	4	< 0.005	< 0.005	0.005	4
	SBA, Check 7	KB001638						< 0.005	< 0.005	9
	SBA, Del Valle Reservoir	DV001000		< 0.005	< 0.005	3	< 0.005			1
	SBA, Del Valle Outlet	DV000000	< 0.005			1	< 0.005	< 0.005	0.008	4
	SBA, Santa Clara Terminal Tank	KB004207		< 0.005	< 0.005	8	< 0.005	< 0.005	0.006	7
Iron	NBA, Barker Sl. Pumping Plant	KG000000	0.014	< 0.005	0.517	23	0.013	< 0.005	0.155	32
	NBA, Cordelia Forebay	KG002111	0.011	< 0.005	0.070	4	0.007	< 0.005	0.075	4
	SBA, Check 7	KB001638					0.008	< 0.005	< 0.029	9
	SBA, Del Valle Reservoir	DV001000	< 0.005	< 0.005	0.006	3	0.007			1
	SBA, Del Valle Outlet	DV000000	< 0.005			1	< 0.005	< 0.005	0.009	4
	SBA, Santa Clara Terminal Tank	KB004207	0.006	< 0.005	0.022	8	0.019	< 0.005	0.006	7
Lead	NBA, Barker Sl. Pumping Plant	KG000000		< 0.005	< 0.005	12	< 0.001	< 0.001	< 0.005	12
	NBA, Cordelia Forebay	KG002111		< 0.005	< 0.005	4	< 0.001	< 0.001	< 0.005	4
	SBA, Check 7	KB001638					< 0.001	< 0.001	< 0.005	9
	SBA, Del Valle Reservoir	DV001000		< 0.005	< 0.005	3	< 0.001	< 0.001	< 0.005	1
	SBA, Del Valle Outlet	DV000000				1	< 0.001	< 0.001	< 0.005	4
	SBA, Santa Clara Terminal Tank	KB004207		< 0.005	< 0.005	8	< 0.001	< 0.001	< 0.005	7
Manganese	NBA, Barker Sl. Pumping Plant	KG000000	0.015	< 0.005	0.358	23	0.019	< 0.005	0.114	32
	NBA, Cordelia Forebay	KG002111	0.006	0.006	0.038	4	0.006	< 0.005	0.016	4
	SBA, Check 7	KB001638					0.008	< 0.005	0.012	9
	SBA, Del Valle Reservoir	DV001000	0.006	0.005	0.028	3	< 0.005			1
	SBA, Del Valle Outlet	DV000000	< 0.005			1		< 0.005	< 0.005	4
	SBA, Santa Clara Terminal Tank	KB004207	0.010	0.005	0.014	8	0.008	< 0.005	0.025	7
Mercury	NBA, Barker Sl. Pumping Plant	KG000000		< 0.001	< 0.001	12	< 0.0002	< 0.0002	< 0.0010	12
	NBA, Cordelia Forebay	KG002111		< 0.001	< 0.001	4	< 0.0002	< 0.0002	< 0.0010	4
	SBA, Check 7	KB001638					< 0.0002	< 0.0002	< 0.0010	9
	SBA, Del Valle Reservoir	DV001000		< 0.001	< 0.001	3	< 0.0002			1
	SBA, Del Valle Outlet	DV000000	< 0.001			1		< 0.0002	< 0.0002	4
	SBA, Santa Clara Terminal Tank	KB004207		< 0.001	< 0.001	8	< 0.0002	< 0.0002	< 0.0010	7
Silver	NBA, Barker Sl. Pumping Plant	KG000000		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	NBA, Cordelia Forebay	KG002111		< 0.005	< 0.005	4		< 0.001	< 0.001	4
	SBA, Check 7	KB001638						< 0.001	< 0.001	9
	SBA, Del Valle Reservoir	DV001000		< 0.005	< 0.005	3	< 0.001			1
	SBA, Del Valle Outlet	DV000000	< 0.005			1		< 0.001	< 0.001	4
	SBA, Santa Clara Terminal Tank	KB004207		< 0.005	< 0.005	8		< 0.001	< 0.001	7
Zinc	NBA, Barker Sl. Pumping Plant	KG000000	< 0.005	< 0.005	0.012	23		< 0.005	< 0.05	32
	NBA, Cordelia Forebay	KG002111		< 0.005	< 0.005	4	< 0.05		< 0.005	4
	SBA, Check 7	KB001638						< 0.005	< 0.05	9
	SBA, Del Valle Reservoir	DV001000	0.240	0.025	0.282	3	0.129			1
	SBA, Del Valle Outlet	DV000000	0.437			1		< 0.05	0.232	4
	SBA, Santa Clara Terminal Tank	KB004207	0.005	< 0.005	0.017	8	< 0.005	< 0.005	0.016	7

The higher levels in 1997 were from salinity intrusion in the Delta that raised bromide levels throughout most of the Project (Figure 3-11).

Figure 3-11
Monthly Iron, Manganese, and Bromide in the North Bay and South Bay Aqueducts

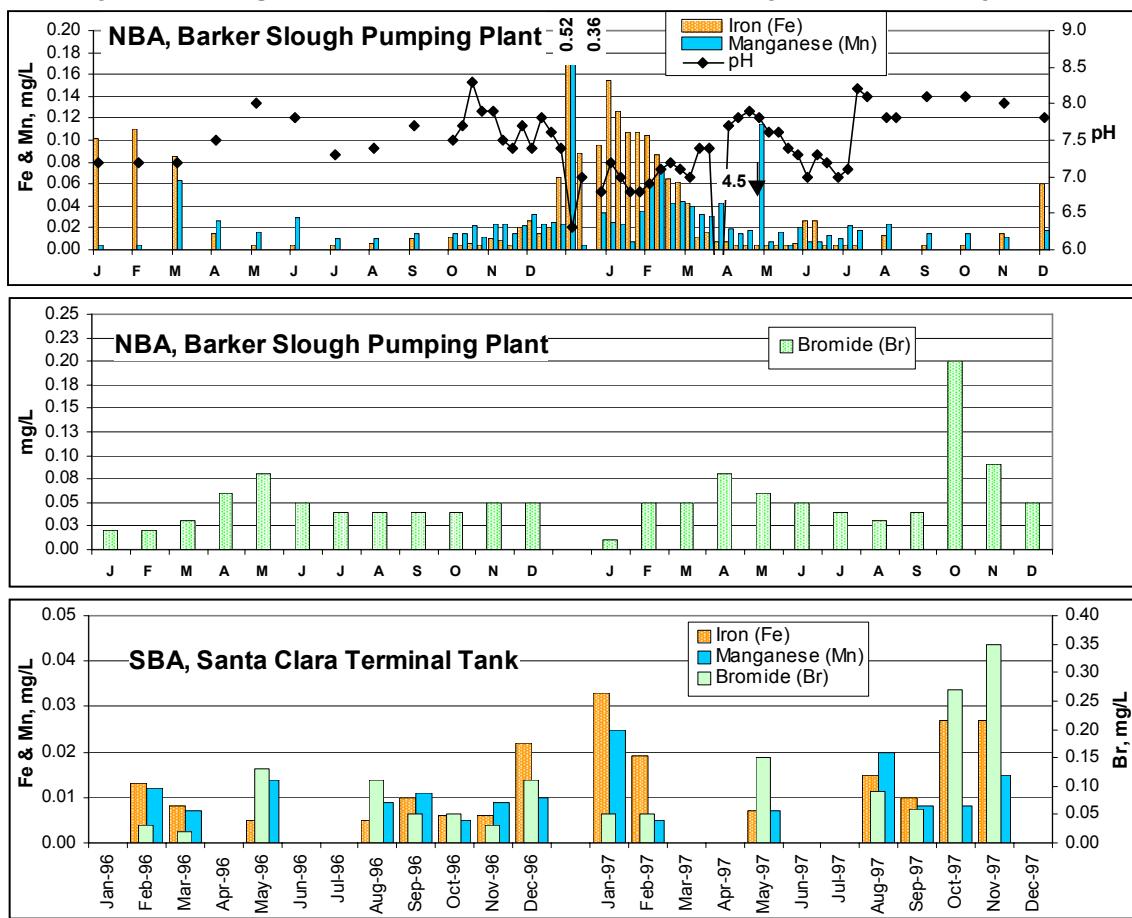


Table 3-6
**Nonmetallic Element Concentrations in the North Bay and South Bay Aqueducts,
 1996-97 (mg/L)**

Parameter	Station Name	I.D#	1996			# of Samples	1997			# of Samples
			Median	Low	High		Median	Low	High	
Arsenic	NBA, Barker Sl. Pumping Plant	KG000000	0.002	0.001	0.003	12	0.002	0.002	0.003	12
	NBA, Cordelia Forebay	KG002111	0.002	0.002	0.003	4	0.003	0.002	0.003	4
	SBA, Check 7	KB001638					0.002	0.001	0.003	9
	SBA, Del Valle Reservoir	DV001000		0.002	0.002	3	0.001			1
	SBA, Del Valle Outlet	DV000000	0.002			1	0.001	< 0.001	0.003	4
	SBA, Santa Clara Terminal Tank	KB004207	0.002	0.001	0.003	8	0.002	0.001	0.002	7
Barium	NBA, Barker Sl. Pumping Plant	KG000000	< 0.050	< 0.050	0.057	12	< 0.050	< 0.050	0.066	12
	NBA, Cordelia Forebay	KG002111	< 0.050	< 0.050	0.059	4	< 0.050	< 0.050	0.059	4
	SBA, Check 7	KB001638					< 0.050	< 0.050	< 0.050	9
	SBA, Del Valle Reservoir	DV001000	0.078	0.073	0.082	3	0.062			1
	SBA, Del Valle Outlet	DV000000	0.070			1	0.064	0.052	0.076	4
	SBA, Santa Clara Terminal Tank	KB004207	< 0.050	< 0.050	0.080	8	< 0.050	< 0.050	0.059	7
Boron	NBA, Barker Sl. Pumping Plant	KG000000	0.2	0.1	0.4	12	0.2	0.1	0.4	12
	NBA, Cordelia Forebay	KG002111	0.2	0.1	0.4	4	0.1	0.1	0.2	4
	SBA, Check 7	KB001638		0.1	0.4		0.1	0.1	0.2	9
	SBA, Del Valle Reservoir	DV001000	0.2	0.1	0.2	3	0.1			1
	SBA, Del Valle Outlet	DV000000	0.1			1	0.1	0.1	0.2	4
	SBA, Santa Clara Terminal Tank	KB004207	0.1	< 0.1	0.2	8	0.1	0.1	0.2	7
Bromide	NBA, Barker Sl. Pumping Plant	KG000000	0.04	0.02	0.08	12	0.05	0.01	0.20	12
	NBA, Cordelia Forebay	KG002111	0.04	0.04	0.10	4	0.05	0.03	0.11	4
	SBA, Check 7	KB001638					0.11	0.09	0.46	9
	SBA, Del Valle Reservoir	DV001000					0.02			1
	SBA, Del Valle Outlet	DV000000	0.02			1		0.01	0.02	2
	SBA, Santa Clara Terminal Tank	KB004207	0.05	0.02	0.13	8	0.09	0.05	0.35	7
Fluoride	NBA, Barker Sl. Pumping Plant	KG000000	0.1	< 0.1	0.2	12	0.1	< 0.1	0.2	12
	NBA, Cordelia Forebay	KG002111	0.1	< 0.1	0.2	4	0.1	< 0.1	0.1	4
	SBA, Check 7	KB001638					< 0.1	< 0.1	< 0.1	9
	SBA, Del Valle Reservoir	DV001000	0.2	0.1	0.2	3	0.1			1
	SBA, Del Valle Outlet	DV000000	0.1			1	0.1	< 0.1	0.2	4
	SBA, Santa Clara Terminal Tank	KB004207	< 0.1	< 0.1	0.2	8	< 0.1	< 0.1	0.2	7
Selenium	NBA, Barker Sl. Pumping Plant	KG000000		< 0.001	< 0.001	12		< 0.001	< 0.001	12
	NBA, Cordelia Forebay	KG002111		< 0.001	< 0.001	4		< 0.001	< 0.001	4
	SBA, Check 7	KB001638						< 0.001	< 0.001	9
	SBA, Del Valle Reservoir	DV001000			< 0.001	3	< 0.001			1
	SBA, Del Valle Outlet	DV000000	< 0.001			1		< 0.001	< 0.001	4
	SBA, Santa Clara Terminal Tank	KB004207	< 0.001	< 0.001	0.001	8	< 0.001	< 0.001	0.001	7

California Aqueduct and Coastal Branch

With the exception of mercury and iron, minor elements in the California Aqueduct and Coastal Branch were below the MCLs for finished drinking water or Article 19 objectives during 1996-97 (Tables 3-7 and 3-8). One sample from Check 41 contained 0.001 mg/L of mercury during 1997. The value was likely due to field or laboratory contamination, since the theoretical concentration of dissolved mercury is much lower. Further, unfiltered mercury concentrations in the Sacramento River are historically below 10 parts per trillion—0.00001 mg/L—or two orders of magnitude lower than the 0.001 mg/L value reported for Check 41 (Project samples are filtered before analysis for metals). One sample from Devil Canyon Afterbay contained 0.776 mg/L of iron during February 1996 and was over the MCL for finished drinking water of 0.3 mg/L (Figure 3-12). Similar to mercury, this number is artificially high for a sample with a field pH of 8.1. The most probable cause of the elevated iron is field contamination by the introduction of soil. Iron is one of the most common elements in soil, as is aluminum and manganese, that were also unusually elevated in the same sample. Two iron values of 0.16 and 0.18 mg/L were reported for Check 21 in January and February 1996 (Figure 3-12) and may have been related to SLC floodwater inflows, since certain floodwaters are iron enriched.

Table 3-7
Metallic Element Concentrations in the California Aqueduct and Coastal Branch, 1996-97
(mg/L)

Parameter	Station Name	I.D#	1996			# of Samples	1997			# of Samples
			Median	Low	High		Median	Low	High	
Aluminum	Clifton Court Forebay	KA000000						0.010	0.021	2
	Banks Pumping Plant	KA000331	< 0.010	< 0.010	0.010	12		< 0.010	< 0.010	12
	Check 13	KA007089	< 0.010	< 0.010	0.049	12	< 0.010	0.010	0.013	12
	Check 21	KA017226	< 0.010	< 0.010	0.080	12		< 0.010	< 0.010	12
	Coastal Branch	KC000934	< 0.010	< 0.010	0.015	8	< 0.010	< 0.010	0.014	12
	Check 29	KA024454		< 0.010	< 0.010	12	< 0.010	< 0.010	0.026	12
	Check 41	KA030341		< 0.010	< 0.010	12		< 0.010	< 0.010	12
	Check 66	KA040341						< 0.010	< 0.010	3
	Devil Canyon Afterbay	KA041288	0.015	< 0.010	0.539	12	< 0.010	< 0.010	< 0.050	12
Cadmium	Clifton Court Forebay	KA000000						< 0.005	< 0.005	2
	Banks Pumping Plant	KA000331		< 0.005	< 0.005	12	< 0.001	< 0.001	< 0.005	12
	Check 13	KA007089	< 0.005	< 0.005	12	< 0.005		< 0.001	< 0.005	12
	Check 21	KA017226	< 0.005	< 0.005	12	< 0.005		< 0.001	< 0.005	12
	Coastal Branch	KC000934	< 0.005	< 0.005	8	< 0.005		< 0.001	< 0.005	12
	Check 29	KA024454	< 0.005	< 0.005	12	< 0.005		< 0.001	< 0.005	12
	Check 41	KA030341	< 0.005	< 0.005	12	< 0.005		< 0.001	< 0.005	12
	Check 66	KA040341						< 0.001	< 0.005	3
	Devil Canyon Afterbay	KA041288	< 0.005	< 0.005	12	< 0.005		< 0.001	< 0.005	12
Copper	Clifton Court Forebay	KA000000						< 0.005	< 0.005	2
	Banks Pumping Plant	KA000331	< 0.005	< 0.005	0.095	12	< 0.002	< 0.002	0.025	12
	Check 13	KA007089	< 0.005	< 0.005	12	< 0.005		< 0.005	0.003	12
	Check 21	KA017226	< 0.005	< 0.005	12	< 0.005		< 0.005	0.006	12
	Coastal Branch	KC000934	< 0.005	< 0.005	9	0.003		< 0.005	0.016	12
	Check 29	KA024454	< 0.005	< 0.005	12	0.002		< 0.005	0.005	12
	Check 41	KA030341	< 0.005	< 0.002	< 0.005	12	0.002	< 0.005	0.005	12
	Check 66	KA040341					0.003	< 0.005	0.003	3
	Devil Canyon Afterbay	KA041288	< 0.005	< 0.005	12	0.002		< 0.005	0.005	12
Chromium	Clifton Court Forebay	KA000000						< 0.005	< 0.005	2
	Banks Pumping Plant	KA000331		< 0.005	< 0.005	12		< 0.005	< 0.005	12
	Check 13	KA007089	< 0.005	< 0.005	12			< 0.005	< 0.005	12
	Check 21	KA017226	< 0.005	< 0.005	12			< 0.005	< 0.005	12
	Coastal Branch	KC000934	< 0.005	< 0.005	9			< 0.005	< 0.005	12
	Check 29	KA024454	< 0.005	< 0.005	12			< 0.005	< 0.005	12
	Check 41	KA030341	< 0.005	< 0.005	12			< 0.005	< 0.005	12
	Check 66	KA040341						< 0.005	< 0.005	3
	Devil Canyon Afterbay	KA041288	< 0.005	< 0.005	12			< 0.005	< 0.005	12
Iron	Clifton Court Forebay	KA000000						< 0.005	0.057	2
	Banks Pumping Plant	KA000331	0.018	0.006	0.083	12	0.008	< 0.005	0.034	12
	Check 13	KA007089	0.018	0.006	0.094	12	< 0.005	< 0.005	0.036	12
	Check 21	KA017226	0.026	< 0.005	0.178	12	< 0.005	< 0.005	0.027	12
	Coastal Branch	KC000934	< 0.005	< 0.005	0.036	9	< 0.005	< 0.005	0.020	12
	Check 29	KA024454	< 0.005	< 0.005	0.036	12	< 0.005	< 0.005	0.039	12
	Check 41	KA030341	< 0.005	< 0.005	0.050	12	< 0.005	< 0.005	0.021	12
	Check 66	KA040341						< 0.005	< 0.005	3
	Devil Canyon Afterbay	KA041288	0.014	< 0.005	0.776	12	< 0.005	< 0.005	0.008	12
Lead	Clifton Court Forebay	KA000000						< 0.001	< 0.001	2
	Banks Pumping Plant	KA000331		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 13	KA007089		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 21	KA017226		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Coastal Branch	KC000934		< 0.005	< 0.005	9		< 0.001	< 0.001	12
	Check 29	KA024454		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 41	KA030341		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 66	KA040341						< 0.001	< 0.001	3
	Devil Canyon Afterbay	KA041288		< 0.005	< 0.005	12		< 0.001	< 0.001	12

Table 3-7 (Con't)
Metallic Element Concentrations in the California Aqueduct and Coastal Branch, 1996-97
(mg/L)

Parameter	Station Name	I.D#	1996			# of Samples	1997			# of Samples
			Median	Low	High		Median	Low	High	
Manganese	Clifton Court Forebay	KA000000						< 0.005	0.057	2
	Banks Pumping Plant	KA000331	0.017	0.010	0.034	12	0.021	0.007	0.034	12
	Check 13	KA007089	0.009	< 0.005	0.024	12	0.006	< 0.005	0.018	12
	Check 21	KA017226	< 0.005	< 0.005	0.007	12		< 0.005	< 0.005	12
	Coastal Branch	KC000934	< 0.005	< 0.005	0.026	9		< 0.005	< 0.005	12
	Check 29	KA024454	< 0.005	< 0.005	0.090	12		< 0.005	< 0.005	12
	Check 41	KA030341		< 0.005	< 0.005	12		< 0.005	< 0.005	12
	Check 66	KA040341						< 0.005	< 0.005	3
	Devil Canyon Afterbay	KA041288	< 0.005	< 0.005	0.134	12	< 0.005	0.210	12	
Mercury	Clifton Court Forebay	KA000000						< 0.0002	< 0.0002	2
	Banks Pumping Plant	KA000331		< 0.001	< 0.001	12		< 0.0002	< 0.0002	12
	Check 13	KA007089		< 0.001	< 0.001	12		< 0.0002	< 0.0002	12
	Check 21	KA017226		< 0.001	< 0.001	12		< 0.0002	< 0.0002	12
	Coastal Branch	KC000934		< 0.001	< 0.001	8		< 0.0002	< 0.0002	9
	Check 29	KA024454		< 0.001	< 0.001	12		< 0.0002	< 0.0002	12
	Check 41	KA030341		< 0.001	< 0.001	12	< 0.0002	< 0.0002	0.0010	12
	Check 66	KA040341						< 0.0002	< 0.0002	2
	Devil Canyon Afterbay	KA041288		< 0.001	< 0.001	12		< 0.0002	< 0.0002	12
Silver	Clifton Court Forebay	KA000000						< 0.001	< 0.001	2
	Banks Pumping Plant	KA000331		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 13	KA007089		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 21	KA017226		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Coastal Branch	KC000934		< 0.005	< 0.005	8		< 0.001	< 0.001	9
	Check 29	KA024454		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 41	KA030341		< 0.005	< 0.005	12		< 0.001	< 0.001	12
	Check 66	KA040341						< 0.001	< 0.001	2
	Devil Canyon Afterbay	KA041288		< 0.005	< 0.005	12		< 0.001	< 0.001	12
Zinc	Clifton Court Forebay	KA000000						< 0.005	< 0.005	2
	Banks Pumping Plant	KA000331	< 0.005	< 0.005	0.006	12	< 0.005	< 0.005	< 0.050	12
	Check 13	KA007089	< 0.005	< 0.005	0.006	12	< 0.005	< 0.005	< 0.050	12
	Check 21	KA017226		< 0.005	< 0.005	12	< 0.005	< 0.005	< 0.050	12
	Coastal Branch	KC000934	< 0.005	< 0.005	0.019	9	< 0.005	< 0.005	< 0.050	9
	Check 29	KA024454		< 0.005	< 0.005	12	< 0.005	< 0.005	< 0.050	12
	Check 41	KA030341	0.005	< 0.005	0.006	12	< 0.005	< 0.005	0.006	12
	Check 66	KA040341						< 0.005	< 0.050	2
	Devil Canyon Afterbay	KA041288	< 0.005	< 0.005	0.007	12		< 0.005	< 0.050	12

Arsenic in the California Aqueduct ranged between 0.001 and 0.004 mg/L and was detected in all but two samples (Table 3-8). Selenium was detected once each year at both Banks Pumping Plant and Check 41 at the reporting limit of 0.001 mg/L. Maximum bromide levels at all stations ranged between 0.19 and 0.21 mg/L in 1996 and between 0.20 and 0.44 mg/L in 1997. The higher 1997 values were due to increased salinity intrusion in the Delta towards the end of 1997 that raised bromide levels throughout most of the California Aqueduct (Figure 3-12).

San Luis Reservoir and Southern California Lakes

In the San Luis Reservoir, all minor elements were below the MCLs for finished drinking water or Article 19 objectives except for manganese (Table 3-9). Manganese was detected once at 0.31 mg/L in August 1997 and was likely due to field or laboratory contamination, since positive detections were infrequent at that station (Figure 3-13).

Table 3-8
Nonmetallic Elements Concentrations in the California Aqueduct and Coastal Branch,
1996-97 (mg/L)

Parameter	Station Name	I.D#	1996			1997			# of Samples	
			Median	Low	High	# of Samples	Median	Low		
Arsenic	Clifton Court Forebay	KA000000					0.002	0.001	0.002	2
	Banks Pumping Plant	KA000331	0.002	0.001	0.002	12	0.002	0.001	0.003	12
	Check 13	KA007089	0.002	0.001	0.002	12	0.002	0.001	0.003	12
	Check 21	KA017226	0.002	0.001	0.002	12	0.002	0.001	0.003	12
	Coastal Branch	KC000934	0.002	0.002	0.002	9	0.002	0.001	0.003	12
	Check 29	KA024454	0.002	0.002	0.002	12	0.002	0.001	0.003	12
	Check 41	KA030341	0.002	0.001	0.002	12	0.002	0.001	0.004	12
	Check 66	KA040341					0.003	0.002	0.003	3
	Devil Canyon Afterbay	KA041288	0.002	0.001	0.002	12	0.002	< 0.001	0.003	12
Barium	Clifton Court Forebay	KA000000						< 0.05	< 0.05	2
	Banks Pumping Plant	KA000331		< 0.05	< 0.05	12		< 0.05	< 0.05	12
	Check 13	KA007089	< 0.05	< 0.05	< 0.05	12		< 0.05	< 0.05	12
	Check 21	KA017226	< 0.05	< 0.05	< 0.05	12		< 0.05	< 0.05	12
	Coastal Branch	KC000934	< 0.01	< 0.05	< 0.05	8		< 0.05	< 0.05	12
	Check 29	KA024454	< 0.05	< 0.05	< 0.05	12		< 0.05	< 0.05	12
	Check 41	KA030341	< 0.05	< 0.05	< 0.05	12		< 0.05	< 0.05	12
	Check 66	KA040341						< 0.05	< 0.05	3
	Devil Canyon Afterbay	KA041288	< 0.05	< 0.05	< 0.05	12		< 0.05	< 0.05	12
Boron	Clifton Court Forebay	KA000000	0.2	< 0.1	0.3	4	0.1	< 0.1	0.3	5
	Banks Pumping Plant	KA000331	0.1	< 0.1	0.3	12	0.1	0.1	0.3	12
	Check 12	KA006633	0.1	< 0.1	0.3	4	0.1	0.1	0.2	4
	Check 13	KA007089	0.1	< 0.1	0.3	12	0.1	0.1	0.2	12
	Check 21	KA017226	0.1	0.1	0.3	12	0.1	0.1	0.2	12
	Coastal Branch	KC000934	0.1	< 0.1	0.2	9	0.1	0.1	0.2	12
	Check 29	KA024454	0.2	< 0.1	0.3	12	0.1	< 0.1	0.2	12
	Check 41	KA030341	0.1	< 0.1	0.3	11	0.1	< 0.1	0.2	12
	Check 66	KA040341	0.1	0.1	0.2	4	0.1	0.1	0.2	4
Bromide	Clifton Court Forebay	KA000000	0.11	0.08	0.20	4	0.10	0.02	0.34	5
	Banks Pumping Plant	KA000331	0.11	0.04	0.21	12	0.10	0.04	0.44	12
	Check 13	KA007089	0.14	0.09	0.19	12	0.12	0.05	0.43	12
	Check 21	KA017226	0.14	0.12	0.21	4	0.15	0.06	0.39	12
	Check 41	KA030341	0.14	0.08	0.20	12	0.16	< 0.01	0.38	5
	Check 66	KA040341					0.16			1
	Devil Canyon Afterbay	KA041288	0.13	0.08	0.15	12	0.14	< 0.01	0.20	12
Fluoride	Clifton Court Forebay	KA000000						< 0.1	< 0.1	3
	Banks Pumping Plant	KA000331		< 0.1	< 0.1	12		< 0.1	< 0.1	12
	Check 13	KA007089	< 0.1	< 0.1	< 0.1	12		< 0.1	< 0.1	12
	Check 21	KA017226	< 0.1	< 0.1	< 0.1	9		< 0.1	< 0.1	12
	Coastal Branch	KC000934	< 0.1	< 0.1	< 0.1	12		< 0.1	< 0.1	12
	Check 29	KA024454	< 0.1	< 0.1	< 0.1	12	< 0.1	< 0.1	0.1	12
	Check 41	KA030341	< 0.1	< 0.1	0.1	11	< 0.1	< 0.1	0.1	12
	Check 66	KA040341	< 0.1	< 0.1	0.1	4		< 0.1	< 0.1	4
	Devil Canyon Afterbay	KA041288	< 0.1	< 0.1	0.1	11	< 0.1	< 0.1	0.3	12
Selenium	Clifton Court Forebay	KA000000						< 0.001	< 0.001	2
	Banks Pumping Plant	KA000331	< 0.001	< 0.001	0.001	12	< 0.001	< 0.001	0.001	12
	Check 13	KA007089	< 0.001	< 0.001	< 0.001	12		< 0.001	< 0.001	12
	Check 21	KA017226	< 0.001	< 0.001	< 0.001	12		< 0.001	< 0.001	12
	Coastal Branch	KC000934	< 0.001	< 0.001	< 0.001	9		< 0.001	< 0.001	12
	Check 29	KA024454	< 0.001	< 0.001	< 0.001	12		< 0.001	< 0.001	12
	Check 41	KA030341	< 0.001	< 0.001	0.001	12	< 0.001	< 0.001	0.001	12
	Check 66	KA040341						< 0.001	< 0.001	3
	Devil Canyon Afterbay	KA041288	< 0.001	< 0.001	< 0.001	12		< 0.001	< 0.001	12

Figure 3-12
Monthly Iron, Manganese, and Bromide in the California Aqueduct, 1996-97

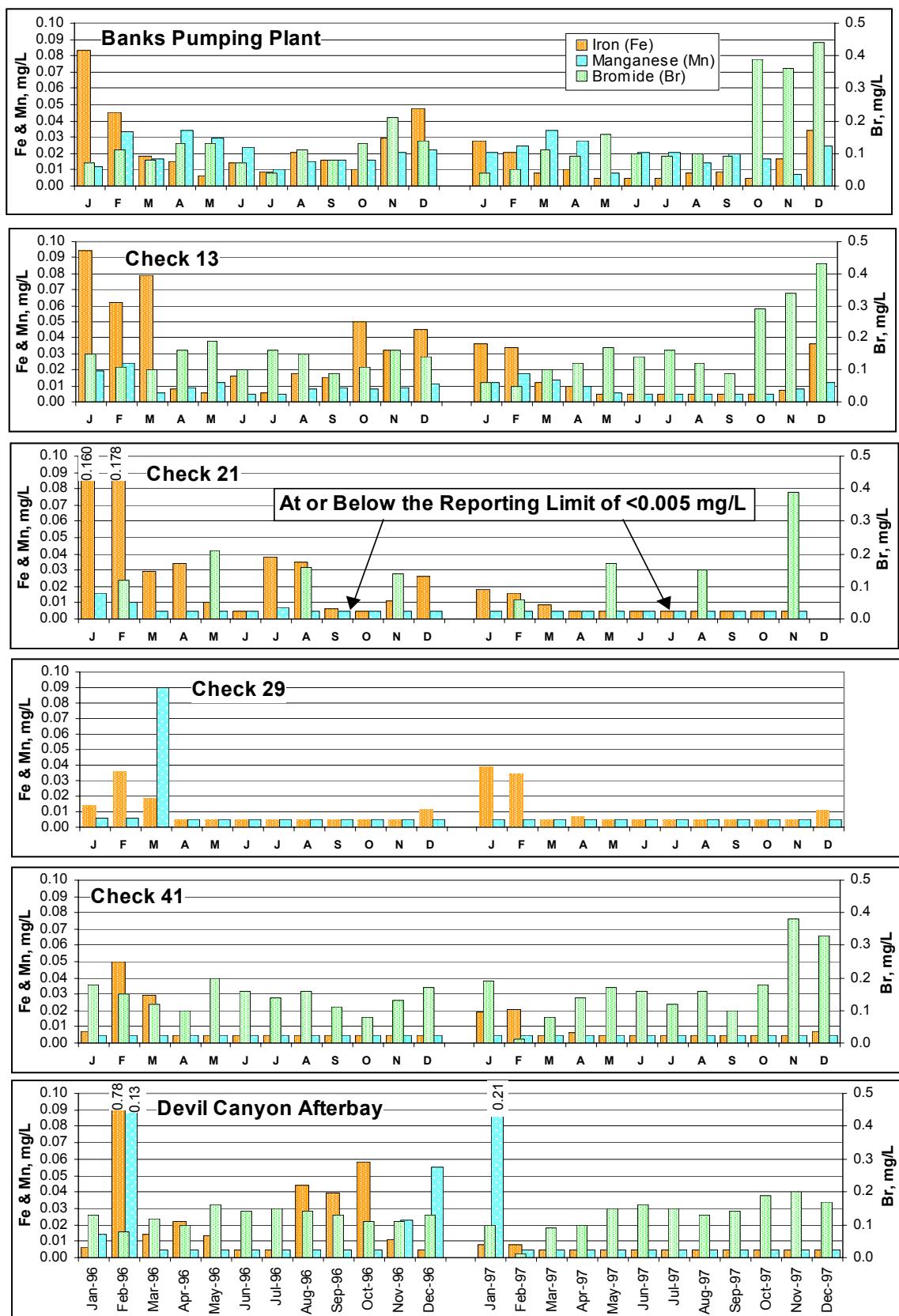
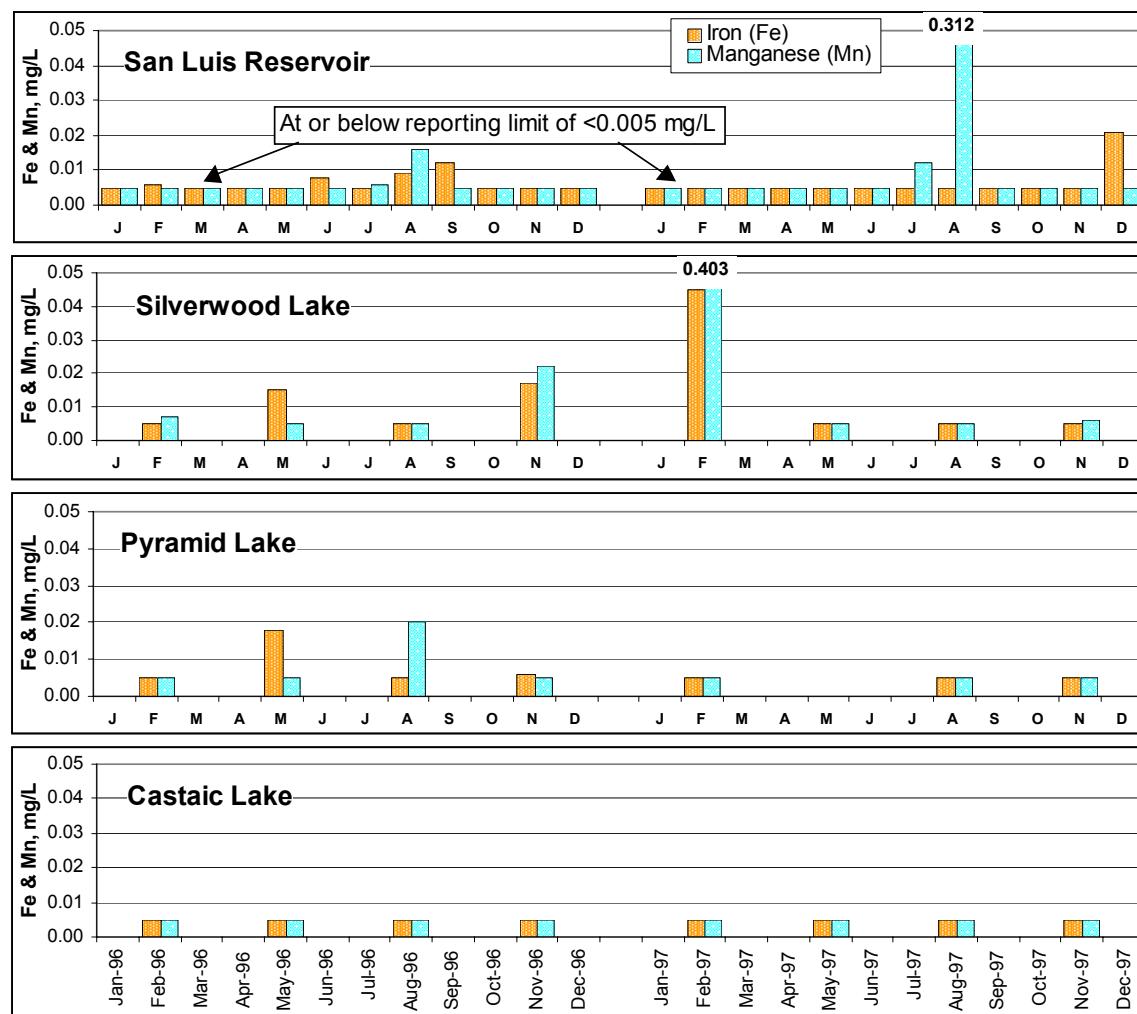


Table 3-9
Minor Element Concentrations in San Luis Reservoir and Southern California Lakes,
1996-97 (mg/L)

Parameter	Station Name	I.D#	1996			1997			# of Samples
			Median	Low	High	# of Samples	Median	Low	
Aluminum	San Luis Reservoir	SL001000	< 0.010	< 0.010	0.014	12	< 0.010	< 0.010	0.011 12
	Pyramid Lake	PY001000	< 0.010	< 0.010	0.017	4	< 0.010	< 0.010	0.010 3
	Castaic Lake	CA002000	< 0.010	< 0.010	0.017	4	< 0.010	< 0.010	0.010 4
	Silverwood Lake	SI002000	< 0.010	< 0.010	0.026	4	< 0.010	< 0.010	0.010 4
	Lake Perris	PE002000	< 0.010	< 0.010	0.010	4	< 0.010	< 0.010	0.010 4
Cadmium	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.005	12	< 0.001	< 0.001	< 0.005 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
Copper	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.005	12	0.002	< 0.005	0.002 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.005	4	0.002	< 0.005	0.003 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.011	4	0.003	< 0.005	0.008 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.005	4	0.004	< 0.005	0.006 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	0.010	0.007	0.017 4
Chromium	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.005	12	< 0.005	< 0.005	< 0.005 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 4
Iron	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.012	12	< 0.005	< 0.005	0.021 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.018	4	< 0.005	< 0.005	< 0.005 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.017	4	< 0.005	< 0.005	0.045 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 4
Lead	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.005	12	< 0.001	< 0.001	< 0.005 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
Manganese	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.016	12	< 0.005	< 0.005	0.312 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.020	4	< 0.005	< 0.005	< 0.005 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	< 0.005 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.022	4	< 0.005	< 0.005	0.403 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.005	< 0.005	0.006 4
Mercury	San Luis Reservoir	SL001000	< 0.001	< 0.001	0.001	12	< 0.0002	< 0.0002	< 0.001 12
	Pyramid Lake	PY001000	< 0.001	< 0.001	0.001	4	< 0.0002	< 0.0002	< 0.001 3
	Castaic Lake	CA002000	< 0.001	< 0.001	0.001	4	< 0.0002	< 0.0002	< 0.001 4
	Silverwood Lake	SI002000	< 0.001	< 0.001	0.001	4	< 0.0002	< 0.0002	< 0.001 4
	Lake Perris	PE002000	< 0.001	< 0.001	0.001	4	< 0.0002	< 0.0002	< 0.001 4
Silver	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.005	12	< 0.001	< 0.001	< 0.005 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.001	< 0.001	< 0.005 4
Zinc	San Luis Reservoir	SL001000	< 0.005	< 0.005	0.050	12	< 0.050	< 0.050	0.012 12
	Pyramid Lake	PY001000	< 0.005	< 0.005	0.005	4	< 0.050	< 0.050	< 0.050 3
	Castaic Lake	CA002000	< 0.005	< 0.005	0.005	4	< 0.050	< 0.050	< 0.050 4
	Silverwood Lake	SI002000	< 0.005	< 0.005	0.005	4	< 0.050	< 0.050	< 0.050 4
	Lake Perris	PE002000	< 0.005	< 0.005	0.005	4	< 0.050	< 0.050	< 0.050 4
Arsenic	San Luis Reservoir	SL001000	0.002	0.002	0.002	12	0.002	0.002	0.004 12
	Pyramid Lake	PY001000	0.002	0.002	0.002	4	0.002	0.002	0.003 3
	Castaic Lake	CA002000	0.002	0.002	0.002	4	0.002	0.002	0.002 4
	Silverwood Lake	SI002000	0.002	0.002	0.002	4	< 0.001	0.003	0.003 4
	Lake Perris	PE002000	0.002	0.002	0.002	4	0.002	0.002	0.002 4
Barium	San Luis Reservoir	SL001000	< 0.050	< 0.050	0.050	12	< 0.050	< 0.050	< 0.050 12
	Pyramid Lake	PY001000	< 0.050	< 0.050	0.050	4	< 0.050	< 0.050	< 0.050 3
	Castaic Lake	CA002000	< 0.050	< 0.050	0.050	4	< 0.050	< 0.050	< 0.050 4
	Silverwood Lake	SI002000	< 0.050	< 0.050	0.050	4	< 0.050	< 0.050	< 0.050 4
	Lake Perris	PE002000	0.052	< 0.050	0.059	4	0.054	< 0.050	0.057 4
Boron	San Luis Reservoir	SL001000	0.2	0.1	0.2	12	0.2	0.1	0.2 12
	Pyramid Lake	PY001000	0.3	0.3	0.4	4	0.2	0.2	0.3 4
	Castaic Lake	CA002000	0.4	0.4	0.4	4	0.3	0.3	0.4 4
	Silverwood Lake	SI002000	0.1	0.1	0.2	4	0.1	< 0.1	0.2 4
	Lake Perris	PE002000	0.2	0.2	0.3	4	0.2	0.2	0.3 4
Fluoride	San Luis Reservoir	SL001000	< 0.1	< 0.1	0.1	12	< 0.1	< 0.1	< 0.1 12
	Pyramid Lake	PY001000	0.2	0.2	0.2	4	0.1	0.1	0.2 4
	Castaic Lake	CA002000	0.3	0.3	0.4	4	0.2	0.2	0.2 4
	Silverwood Lake	SI002000	< 0.1	< 0.1	0.1	4	< 0.1	0.1	0.1 4
	Lake Perris	PE002000	0.2	0.1	0.2	4	0.1	0.1	0.1 4
Selenium	San Luis Reservoir	SL001000	< 0.001	< 0.001	0.001	12	< 0.001	< 0.001	< 0.001 12
	Pyramid Lake	PY001000	< 0.001	< 0.001	0.001	4	< 0.001	< 0.001	< 0.001 3
	Castaic Lake	CA002000	< 0.001	< 0.001	0.001	4	< 0.001	< 0.001	< 0.001 4
	Silverwood Lake	SI002000	< 0.001	< 0.001	0.001	4	< 0.001	< 0.001	< 0.001 4
	Lake Perris	PE002000	< 0.001	< 0.001	0.001	4	< 0.001	< 0.001	< 0.001 4

Figure 3-13
Monthly Iron and Manganese in San Luis Reservoir and Southern California Lakes



In Southern California lakes, copper, iron, manganese, arsenic, boron, and fluoride were the only minor elements routinely detected (Table 3-9). All values were below the MCLs for finished drinking water or Article 19 objectives, with the exception of one sample collected at Silverwood Lake that contained manganese at 0.403 mg/L (Figure 3-13). The sample, collected in February 1997, also contained iron at 0.045 mg/L, indicating the likelihood of sample contamination. Although water in Silverwood Lake was affected by Kern River inflows in February, iron and manganese were not elevated in those inflows and would not have been the cause of the elevated iron and manganese.

Nutrients

Nutrients enhance plant growth in surface waters and include nitrogen and phosphorus compounds. Nitrogen compounds monitored in the Project include nitrate+nitrite, organic nitrogen, and dissolved ammonia (present largely as the ammonium ion). Phosphorus analyses include total phosphorus and dissolved orthophosphate. The Primary MCL for nitrite as nitrogen is 0.4 mg/L and the MCL for

nitrate+nitrite as nitrogen is 10 mg/L. No standards or objectives exist for the other nutrients.

Feather River Watershed

Nutrients were below all MCLs for finished drinking water in all samples collected from Project stations in the Feather River watershed during 1996-97 (Table 3-10). Organic nitrogen and total phosphorus were the only nutrients detected in Antelope and Frenchman lakes and Lake Davis. These compounds were also routinely detected at or near the reporting limits in Thermalito Afterbay and Oroville Lake.

Table 3-10
Nutrient Concentrations in the Feather River Watershed, 1996-97

Parameter	Station Name	I.D. #	1996			# of Samples	1997			# of Samples
			Mean	Low	High		Mean	Low	High	
Dissolved Ammonia mg/L as N	Antelope Lake	AN001000	< 0.01			1	< 0.01			1
	Frenchman Lake	FR001000	< 0.01			1	< 0.01			1
	Lake Davis	LD001000	< 0.01			1	< 0.01			1
	Oroville Lake	OR001000		< 0.01	< 0.01	8	0.01	< 0.01	0.02	8
	Thermalito Afterbay	TA001000		< 0.01	< 0.01	11	< 0.01	0.01		12
Nitrate + Nitrite mg/L as N	Antelope Lake	AN001000	< 0.01			1	< 0.01			1
	Frenchman Lake	FR001000	< 0.01			1	< 0.01			1
	Lake Davis	LD001000	< 0.01			1	< 0.01			1
	Oroville Lake	OR001000	0.02	< 0.01	0.04	8	0.01	< 0.01	0.02	8
	Thermalito Afterbay	TA001000	0.02	< 0.01	0.07	11	0.02	< 0.01	0.04	12
Organic Nitrogen mg/L	Antelope Lake	AN001000	0.30			1	0.30			1
	Frenchman Lake	FR001000	0.20			1	0.20			1
	Lake Davis	LD001000	0.30			1	0.03			1
	Oroville Lake	OR001000	0.16	< 0.10	0.30	8	0.15	0.10	0.20	8
	Thermalito Afterbay	TA001000	0.11	< 0.10	0.20	11	0.19	0.10	0.30	12
Dissolved Orthophosphate mg/L as P	Antelope Lake	AN001000	< 0.01			1	< 0.01			1
	Frenchman Lake	FR001000	< 0.01			1	< 0.01			1
	Lake Davis	LD001000	< 0.01			1	< 0.01			1
	Oroville Lake	OR001000		< 0.01	0.01	8		< 0.01	< 0.01	8
	Thermalito Afterbay	TA001000		< 0.01	0.01	11		< 0.01	0.01	12
Total Phosphorus mg/L	Antelope Lake	AN001000	0.02			1	0.03			1
	Frenchman Lake	FR001000	< 0.01			1	< 0.01			1
	Lake Davis	LD001000	0.02			1	0.01			1
	Oroville Lake	OR001000	0.03	0.01	0.12	8	0.01	< 0.01	0.02	8
	Thermalito Afterbay	TA001000	0.02	< 0.01	0.06	11	0.04	0.01	0.18	12

North Bay and South Bay Aqueducts

In the North Bay Aqueduct at Barker Slough Pumping Plant, nutrient levels during 1996-97 were below all MCLs for finished drinking water but routinely above their respective reporting limits (Table 3-11).

Levels were highest during the rainy season months of December through February (Figure 3-14).

Seasonal nutrient surges coincided with rainfall runoff from the upstream watershed. A detailed discussion of these trends is presented in Special Investigations (Chapter IV).

In the South Bay Aqueduct at Check 7, nutrients were below their respective MCLs for finished drinking water in all 1996-97 samples (Table 3-11). Monthly nutrient monitoring began in March 1997 at Check 7 in the South Bay Aqueduct (Figure 3-14).

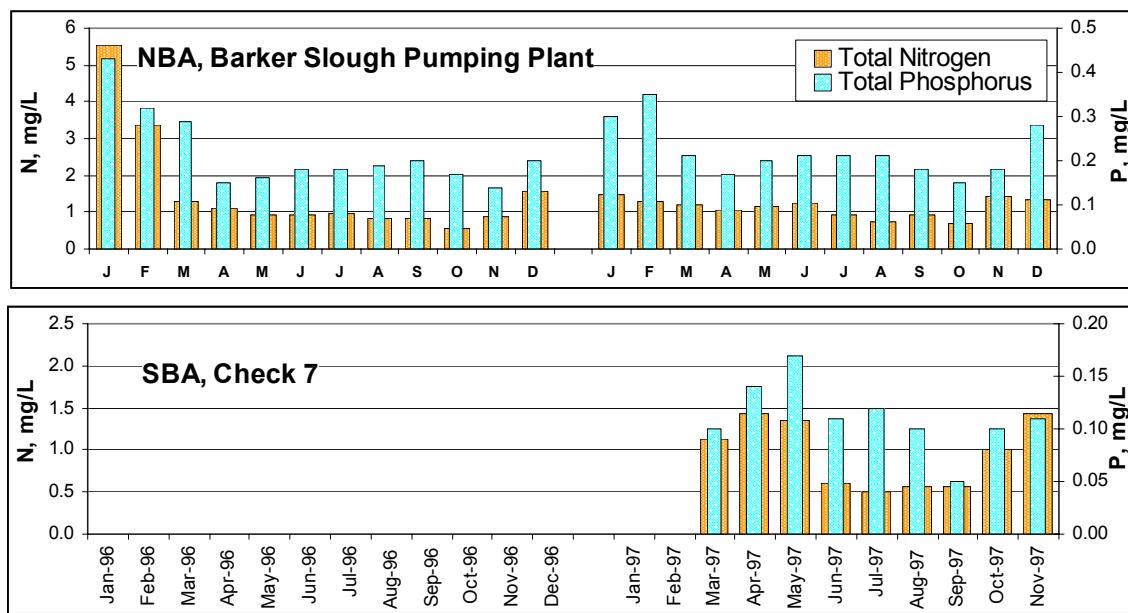
The highest levels of nitrate+nitrite in Del Valle Reservoir were detected during the rainy season months of both years, indicating seasonal increases from the local watershed drained by Arroyo Valle Creek.

During the dry season, nitrate+nitrite in reservoir water was usually near or below the reporting limit of <0.01 mg/L. Dissolved orthophosphate and ammonia were consistently near or below their respective reporting limits at both Del Valle stations.

Table 3-11
Nutrient Concentrations in the North Bay and South Bay Aqueducts, 1996-97

Parameter	Station Name	I.D. #	1996			1997			# of Samples		
			Mean	Low	High	Mean	Low	High	# of Samples		
Dissolved Ammonia mg/L as N	NBA, Barker Sl. Pumping Plant	KG000000	0.03	0.01	0.08	12	0.04	0.01	0.07	12	
	SBA, Check 7	KB001632					0.02	< 0.01	0.05	9	
	SBA, Del Valle Reservoir	DV001000	0.01	< 0.01	0.03	7	0.01	< 0.01	0.03	9	
	SBA, Del Valle Outlet	DV000000	< 0.01			1		< 0.01	< 0.01	4	
Nitrate + Nitrite mg/L as N	NBA, Barker Sl. Pumping Plant	KG000000	0.65	0.13	3.50	12	0.32	0.11	0.61	12	
	SBA, Check 7	KB001632					0.47	0.06	0.89	9	
	SBA, Del Valle Reservoir	DV001000	0.07	< 0.01	0.39	7	0.07	< 0.01	0.47	9	
	SBA, Del Valle Outlet	DV000000	0.05			1	0.13	< 0.01	0.38	4	
Organic Nitrogen mg/L	NBA, Barker Sl. Pumping Plant	KG000000	0.9	0.4	2.0	12	0.8	0.4	1.3	12	
	SBA, Check 7	KB001632					0.5	0.3	0.8	9	
	SBA, Del Valle Reservoir	DV001000	0.3	0.3	0.4	7	0.4	0.3	0.6	9	
	SBA, Del Valle Outlet	DV000000	0.2			1	0.3	0.3	0.3	4	
Dissolved Orthophosphate mg/L as P	NBA, Barker Sl. Pumping Plant	KG000000	0.09	0.05	0.12	12	0.10	0.01	0.12	12	
	SBA, Check 7	KB001632					0.06	0.04	0.12	9	
	SBA, Del Valle Reservoir	DV001000		< 0.01	< 0.01	7		< 0.01	0.01	9	
	SBA, Del Valle Outlet	DV000000	< 0.01			1	0.01	< 0.01	0.02	4	
Total Phosphorus mg/L	NBA, Barker Sl. Pumping Plant	KG000000	0.22	0.14	0.43	12	0.22	0.15	0.35	12	
	SBA, Check 7	KB001632					0.11	0.05	0.17	9	
	SBA, Del Valle Reservoir	DV001000	0.02	< 0.01	0.04	7	0.02	< 0.01	0.06	9	
	SBA, Del Valle Outlet	DV000000	0.07			1	0.03	< 0.01	0.06	4	

Figure 3-14
Monthly Nutrient Concentrations in the North Bay and South Bay Aqueducts



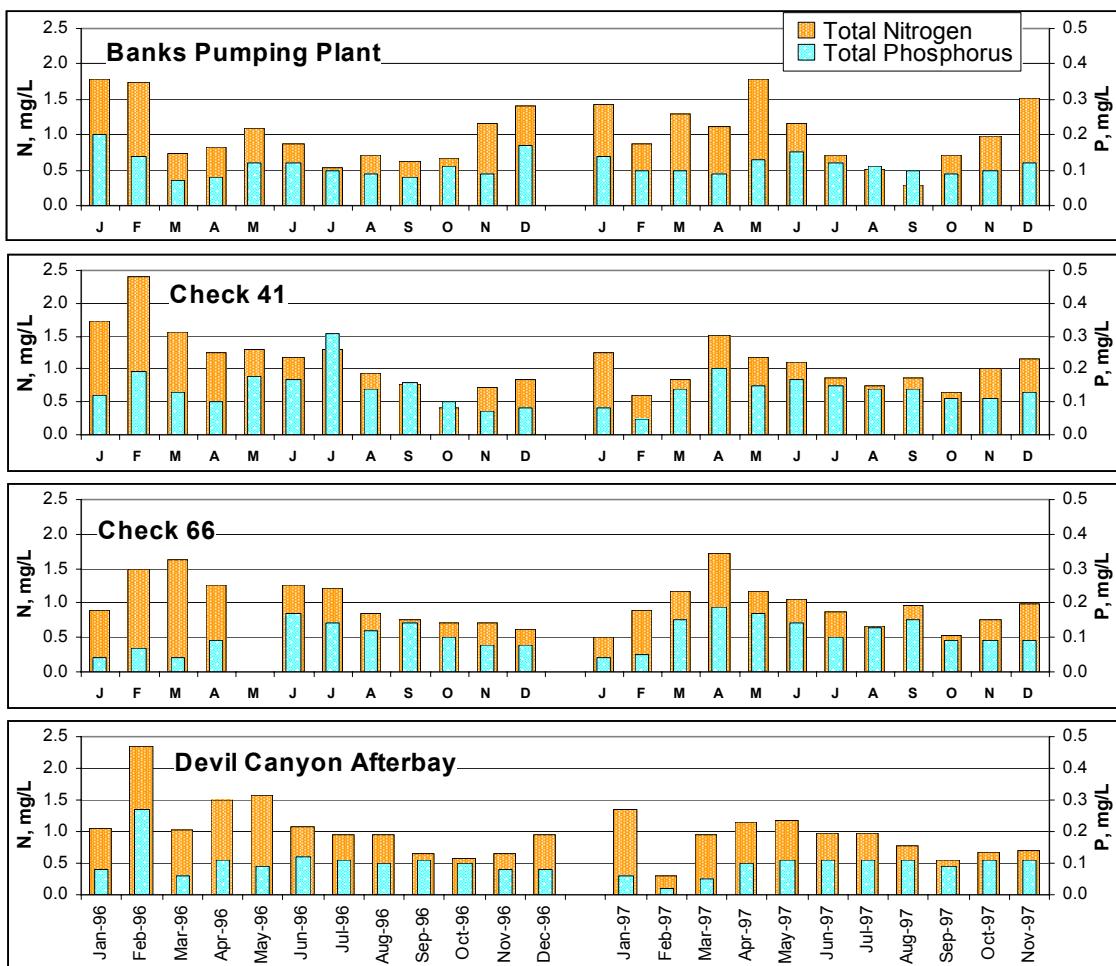
California Aqueduct

Nutrients in the California Aqueduct were routinely detected above their reporting limits, but below all MCLs for finished drinking water during 1996-97 (Table 3-12). Total nitrogen at most stations declined throughout the summer until October or November during both years (Figure 3-15). Total nitrogen was

Table 3-12
Nutrient Concentrations in the California Aqueduct, 1996-97

Parameter	Station Name	I.D. #	1996			1997			# of Samples		
			Mean	Low	High	Mean	Low	High	# of Samples	# of Samples	# of Samples
Dissolved Ammonia mg/L as N	Banks Pumping Plant	KA000331	0.05	0.02	0.14		12	0.08	0.02	0.25	12
	Check 41	KA030341	0.01	< 0.01	0.03		12	0.01	< 0.01	0.02	12
	Check 66	KA040341	0.02	< 0.01	0.04		11	0.02	< 0.01	0.10	12
	Devil Canyon Afterbay	KA041288	0.05	0.01	0.25		12	0.04	< 0.01	0.20	13
Nitrate + Nitrite mg/L as N	Banks Pumping Plant	KA000331	0.55	0.19	1.20		12	0.54	0.09	0.88	12
	Check 41	KA030341	0.68	0.20	1.58		12	0.56	0.14	1.00	12
	Check 66	KA040341	0.46	0.07	0.88		11	0.48	0.08	1.00	12
	Devil Canyon Afterbay	KA041288	0.54	0.24	0.90		12	0.43	0.20	0.72	13
Organic Nitrogen mg/L	Banks Pumping Plant	KA000331	0.4	0.2	0.9		12	0.4	0.3	0.8	12
	Check 41	KA030341	0.5	0.2	0.9		12	0.4	0.3	0.5	12
	Check 66	KA040341	0.6	0.4	0.9		11	0.4	0.3	0.7	12
	Devil Canyon Afterbay	KA041288	0.5	0.2	1.3		12	0.4	0.1	0.6	13
Dissolved Orthophosphate mg/L as P	Banks Pumping Plant	KA000331	0.07	0.02	0.12		12	0.07	0.04	0.10	12
	Check 41	KA030341	0.10	0.05	0.23		12	0.07	0.03	0.10	12
	Check 66	KA040341	0.06	0.01	0.10		11	0.07	0.01	0.10	12
	Devil Canyon Afterbay	KA041288	0.06	0.02	0.09		12	0.06	< 0.01	0.10	13
Total Phosphorus mg/L	Banks Pumping Plant	KA000331	0.11	0.07	0.20		12	0.11	0.09	0.15	12
	Check 41	KA030341	0.15	0.07	0.31		12	0.13	0.05	0.20	12
	Check 66	KA040341	0.10	0.03	0.10		11	0.12	0.04	0.19	12
	Devil Canyon Afterbay	KA041288	0.11	0.06	0.27		12	0.09	0.02	0.11	13

Figure 3-15
Monthly Nutrient Concentrations in the California Aqueduct



highest in the first few months of 1996, indicating increases caused by early season runoff from the Central Valley. The same trend was not observed in 1997 when total nitrogen levels increased in the spring. Seasonal trends for total phosphorus were not as well defined.

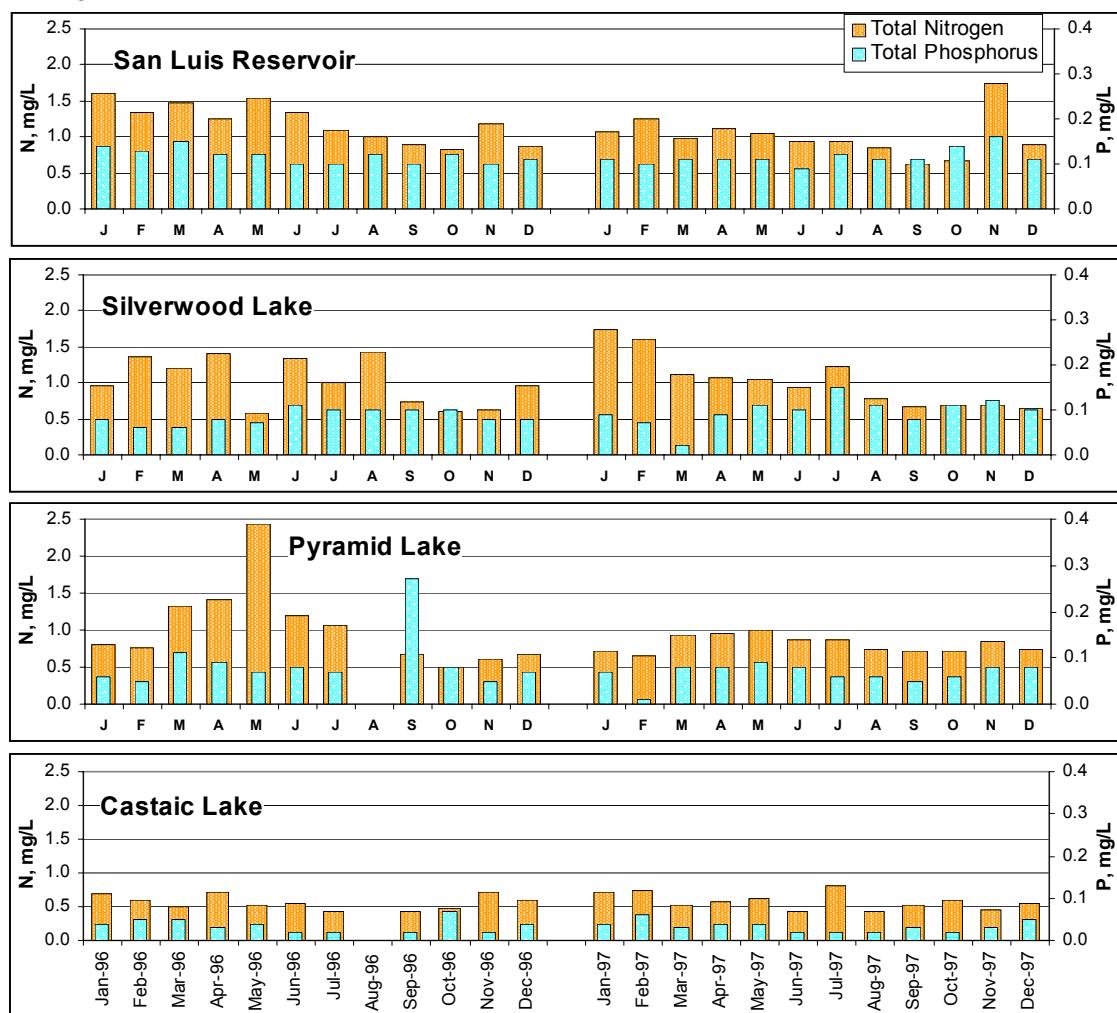
San Luis Reservoir and Southern California Lakes

All nutrients in San Luis Reservoir and Southern California lakes were below their respective MCLs for finished drinking water during 1996-97 (Table 3-13). Total nitrogen in San Luis Reservoir generally declined from January to October during each year. Seasonal nutrient trends were not consistent between any of the lake stations during 1996-97 but were lowest in Castaic Lake (Figure 3-16). Nutrient loads to Southern California lakes are discussed in Special Investigations (Chapter IV).

Table 3-13
Nutrient Concentrations in San Luis Reservoir and Southern California Lakes, 1996-97

Parameter	Station Name	I.D. #	1996			# of Samples	1997			# of Samples
			Mean	Low	High		Mean	Low	High	
Dissolved Ammonia mg/L as N	San Luis Reservoir	SL001000	0.02	< 0.01	0.04	12	0.02	< 0.01	0.07	12
	San Luis Res., Tunnel Isl.	SL005000	0.01	< 0.01	0.02	12	0.03	< 0.01	0.07	12
	Pyramid Lake	PY001000	0.02	< 0.01	0.06	11	0.01	< 0.01	0.03	12
	Castaic Lake	CA002000	0.01	< 0.01	0.03	11	0.01	< 0.01	0.03	12
	Silverwood Lake	SI002000	0.02	< 0.01	0.06	12	0.08	< 0.01	0.24	12
	Lake Perris	PE002000	0.02	< 0.01	0.06	12	0.06	< 0.01	0.04	12
Nitrate + Nitrite mg/L as N	San Luis Reservoir	SL001000	0.73	0.50	1.20	12	0.59	0.20	1.39	12
	San Luis Res., Tunnel Isl.	SL005000	0.68	0.46	0.90	12	0.54	0.05	1.20	12
	Pyramid Lake	PY001000	0.49	0.29	0.71	11	0.48	0.32	0.58	12
	Castaic Lake	CA002000	0.14	< 0.01	0.38	11	0.15	< 0.01	0.42	12
	Silverwood Lake	SI002000	0.51	0.25	0.70	12	0.53	0.23	0.77	12
	Lake Perris	PE002000	0.01	0.01	0.03	12	0.06	< 0.01	0.20	12
Organic Nitrogen mg/L	San Luis Reservoir	SL001000	0.5	0.3	0.9	12	0.4	0.2	0.6	12
	San Luis Res., Tunnel Isl.	SL005000	0.4	0.2	0.8	12	0.4	0.3	0.8	12
	Pyramid Lake	PY001000	0.5	0.2	2.1	11	0.3	< 0.1	0.6	12
	Castaic Lake	CA002000	0.4	0.2	0.6	11	0.4	0.2	0.8	12
	Silverwood Lake	SI002000	0.5	0.2	0.9	12	0.5	0.2	0.8	12
	Lake Perris	PE002000	0.6	0.3	1.2	12	0.4	0.3	0.6	12
Dissolved Orthophosphate mg/L as P	San Luis Reservoir	SL001000	0.08	0.06	0.10	12	0.08	0.05	0.10	12
	San Luis Res., Tunnel Isl.	SL005000	0.08	0.05	0.11	12	0.09	0.07	0.13	12
	Pyramid Lake	PY001000	0.05	0.05	0.07	11	0.05	0.03	0.06	12
	Castaic Lake	CA002000	0.02	< 0.01	0.03	11	0.02	< 0.01	0.04	12
	Silverwood Lake	SI002000	0.06	0.02	0.09	12	0.06	< 0.01	0.11	12
	Lake Perris	PE002000	0.02	< 0.01	0.04	12	0.02	< 0.01	0.05	12
Total Phosphorus mg/L	San Luis Reservoir	SL001000	0.12	0.10	0.50	12	0.12	0.09	0.09	12
	San Luis Res., Tunnel Isl.	SL005000	0.12	0.10	0.16	12	0.12	0.09	0.09	12
	Pyramid Lake	PY001000	0.09	0.05	0.27	11	0.07	0.01	0.01	12
	Castaic Lake	CA002000	0.04	0.02	0.07	11	0.03	0.02	0.02	12
	Silverwood Lake	SI002000	0.09	0.06	0.11	12	0.09	0.02	0.02	12
	Lake Perris	PE002000	0.04	< 0.01	0.08	12	0.04	< 0.01	0.08	12

Figure 3-16
Monthly Nutrient Concentrations in San Luis Reservoir and Southern California Lakes



Organic Compounds

Organic compound analyses include total organic carbon, total trihalomethane formation potential, as well as chemicals such as insecticides and herbicides. Measurements of UV 254—a spectrophotometric indicator of both dissolved and total organic carbon—also exists for Barker Slough Pumping Plant on the North Bay Aqueduct. Total organic carbon is a measure of all waterborne organic carbon including the trihalomethane precursors, humic and fulvic acids. TTHMFP is a measure of the capacity for trihalomethanes to form when disinfectants are added during the water treatment process. MCLs for organic chemicals such as pesticides and insecticides are presented in Appendix B, Table B-3.

Total Organic Carbon and Trihalomethane Formation Potential

North Bay and South Bay Aqueducts

On the North Bay Aqueduct at Barker Slough Pumping Plant, dissolved organic carbon levels were similar for both years, ranging from 4.3 to 14.5 mg/L in 1996 and from 4.6 to 13.8 mg/L in 1997 (Figure 3-17). This was not the case for TOC or TTHMFP, which exhibited higher peak values in 1996. Both TOC and DOC were well correlated with UV 254 (Figure 3-18). TOC and TTHMFP were highest

Figure 3-17
TOC, DOC, TTHMFP, and UV 254 Measurements in the North Bay Aqueduct at Barker Slough Pumping Plant, 1996-97

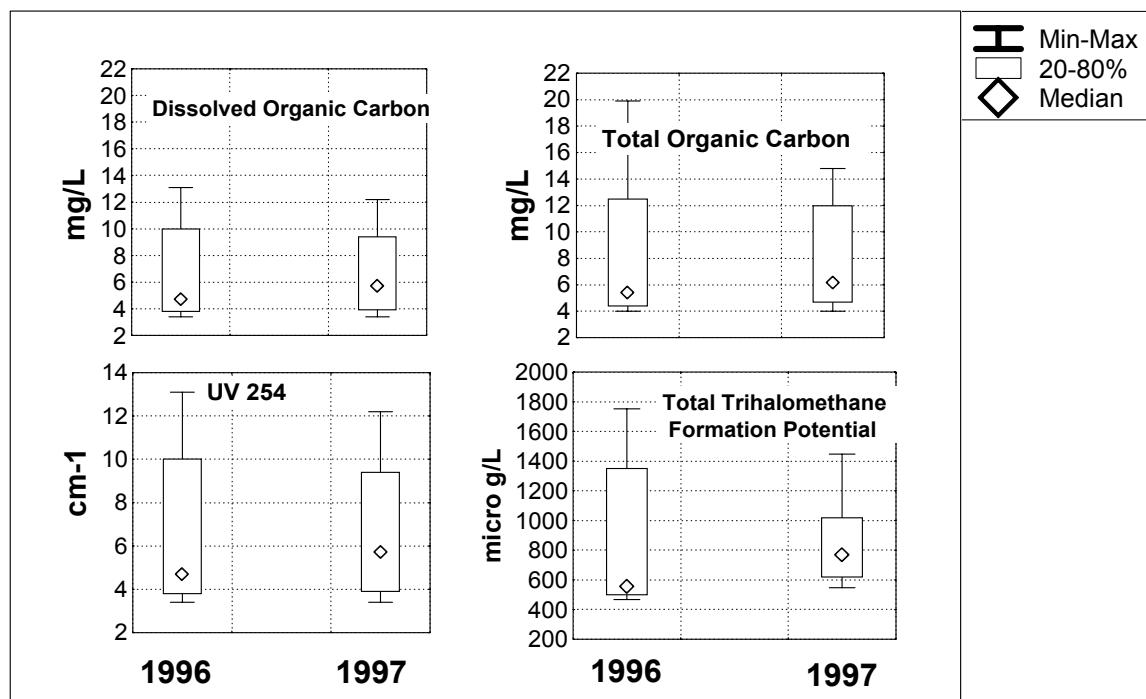
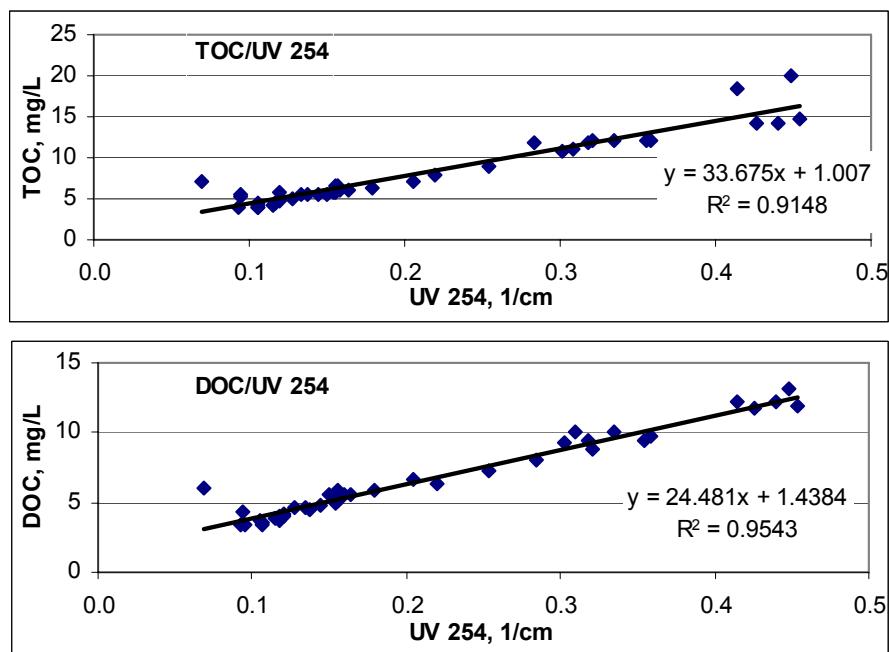


Figure 3-18
Correlation Between Total and Dissolved Organic Carbon and UV 254 at Barker Slough Pumping Plant



during the winter, when rainfall runoff flushes organic carbon, as well as other parameters, from the upstream watershed (Figure 3-19). Over 90 percent of the TTHMFP was made up of chloroform (Figure 3-20). A detailed discussion of these trends is presented in Special Investigations (Chapter IV).

On the South Bay Aqueduct at Check 7, monitoring for TOC and TTHMFP started in April 1997 (Figure 3-19).

Figure 3-19
Monthly TOC and TTHMFP in the North Bay and South Bay Aqueducts

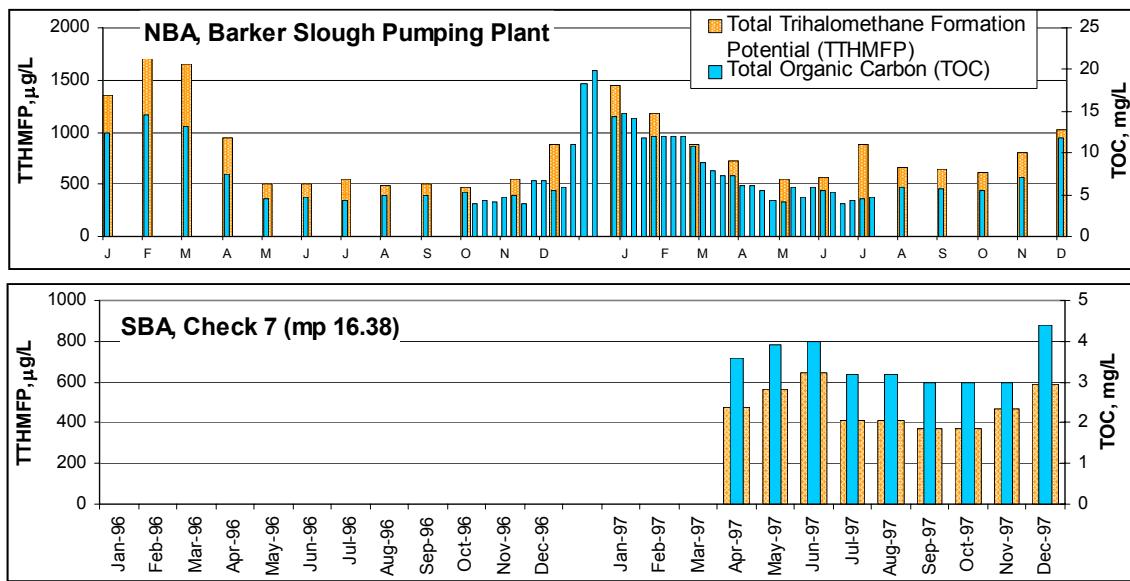


Figure 3-20
Percentage by Concentration of Individual Trihalomethanes Composing TTHMFP in the Project

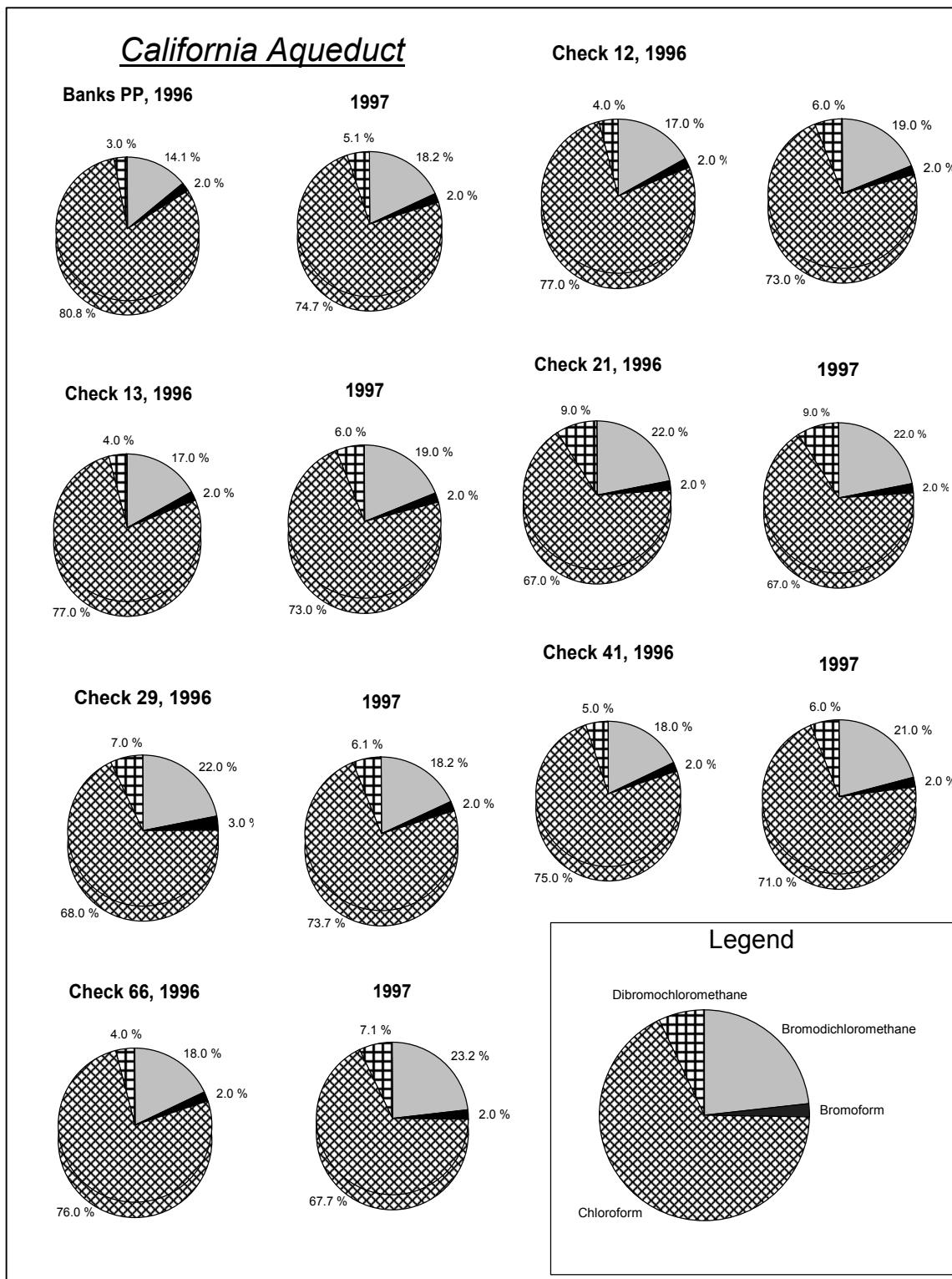
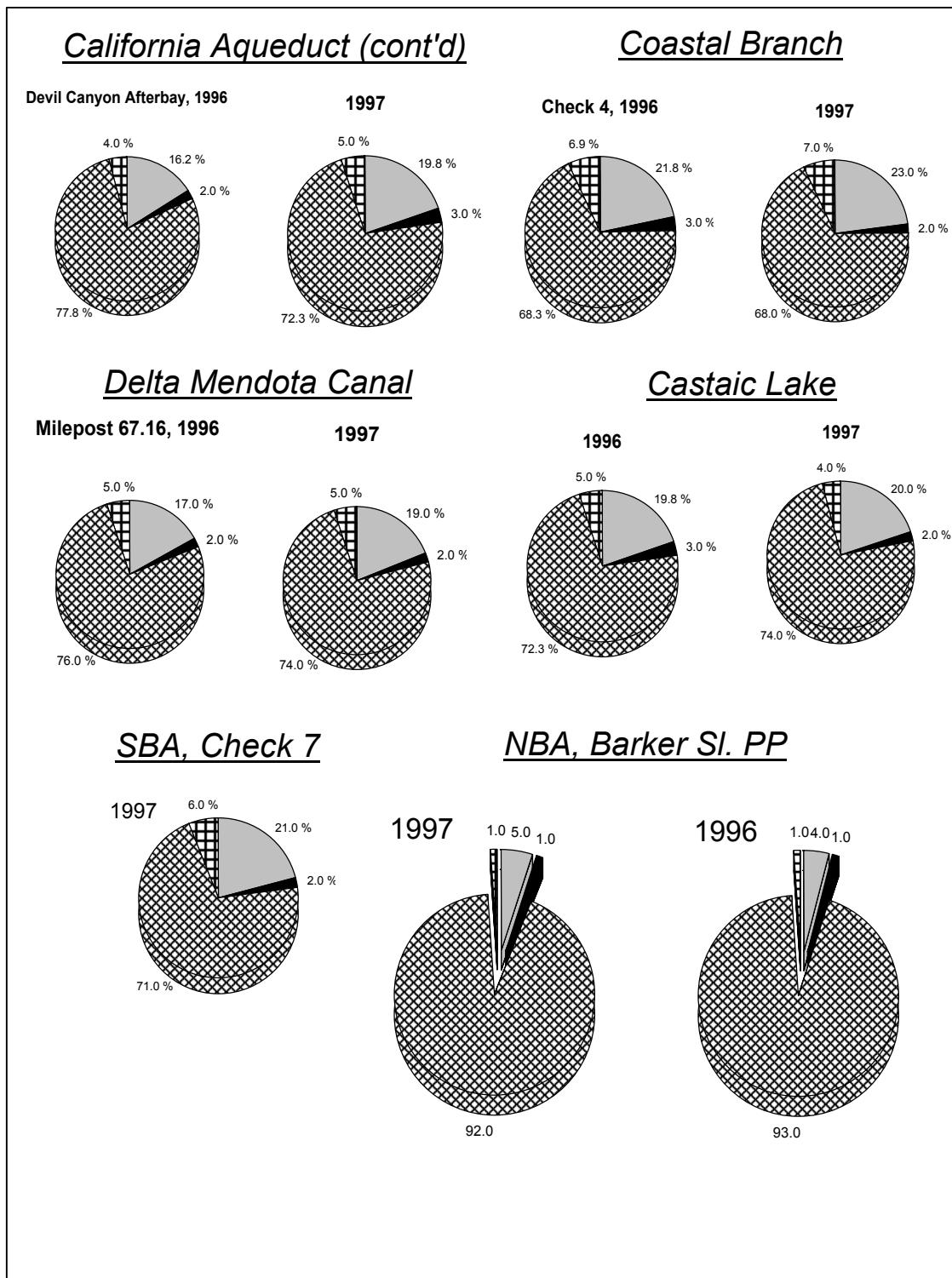


Figure 3-20 (Con't)
Percentage by Concentration of Individual Trihalomethanes Composing TTHMFP in the Project



California Aqueduct and Coastal Branch

Total organic carbon ranged between 2.7 and 8.1 mg/L in 1996 and between 1.8 and 4.8 mg/L in 1997 at all stations monitored in the California Aqueduct (Figure 3-21). The higher levels in 1996 were the result of several factors. First, increases in Aqueduct TOC coincided with early or late season runoff in the Central Valley (Figure 3-22). Second, a TOC value of 8.1 mg/L was reported at Check 41 in July 1996, while a corresponding increase in TTHMFP was not observed. No known non-Project inflows (which might explain the elevated TOC) occurred during that month. Lastly, TOC and TTHMFP were elevated at Devil Canyon Afterbay in February 1996 and may have been due to upstream floodwater inflows in the SLC. Local inflows were not suspect since the mineralogical makeup of that sample was more similar to Project inflows.

During both years, chloroform composed 67 to 81 percent of the TTHMFP concentrations, followed by bromodichloromethane with 14 to 22 percent, dibromochloromethane with 3 to 9 percent, and bromoform with 2 to 3 percent (Figure 3-20). Chloroform percentages were slightly higher in 1996 than 1997 at all stations except Check 29; the reverse was true for dibromo- and bromodichloromethane percentages that composed a larger percentage of the total during 1997 than 1996.

Southern California Lakes

At Castaic Lake, TOC and TTHMFP were highest in May or August of 1996 and 1997 (Figure 3-23). Chloroform composed 72 to 74 percent of the TTHMFP in both years, followed by bromodichloromethane with 20 percent (Figure 3-20).

Figure 3-21
TOC and TTHMFP in the California Aqueduct and Coastal Branch, 1996-97

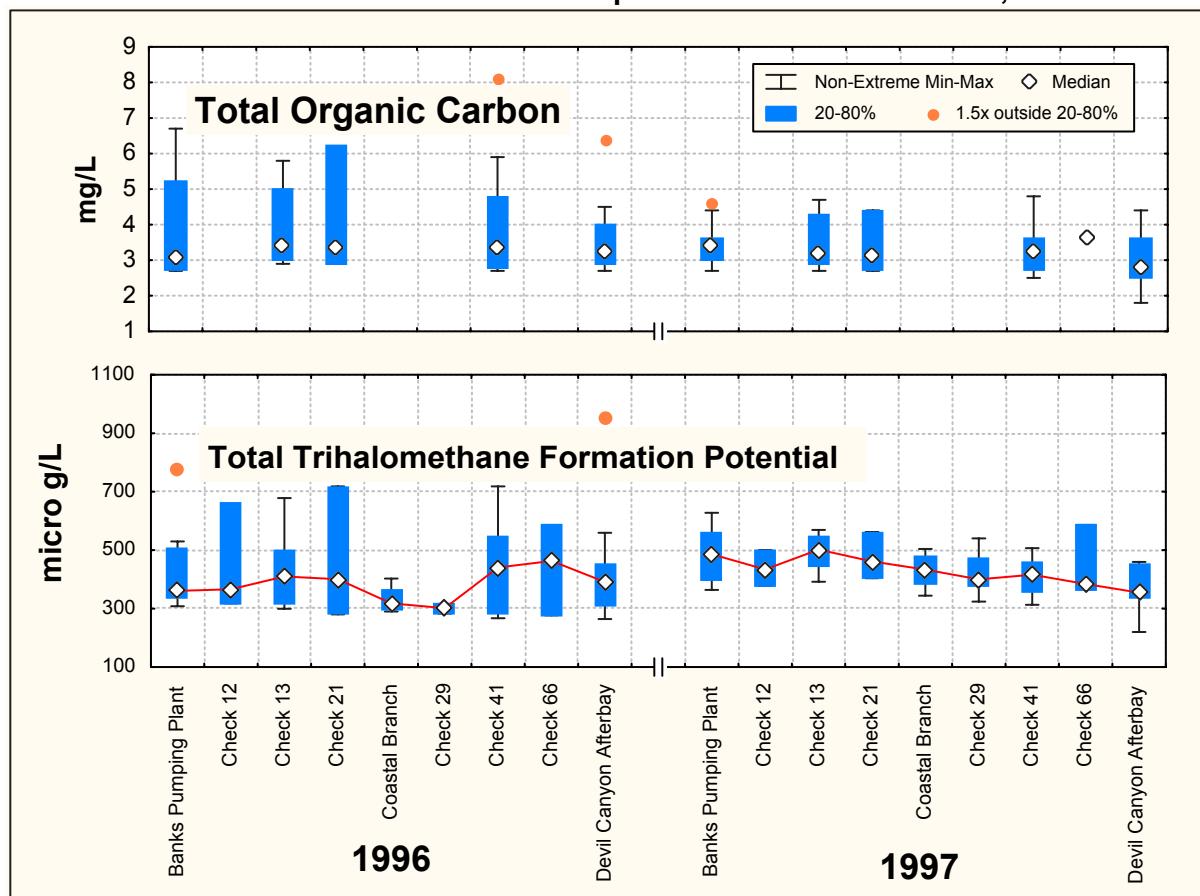


Figure 3-22
Monthly TOC and TTHMFP in the California Aqueduct

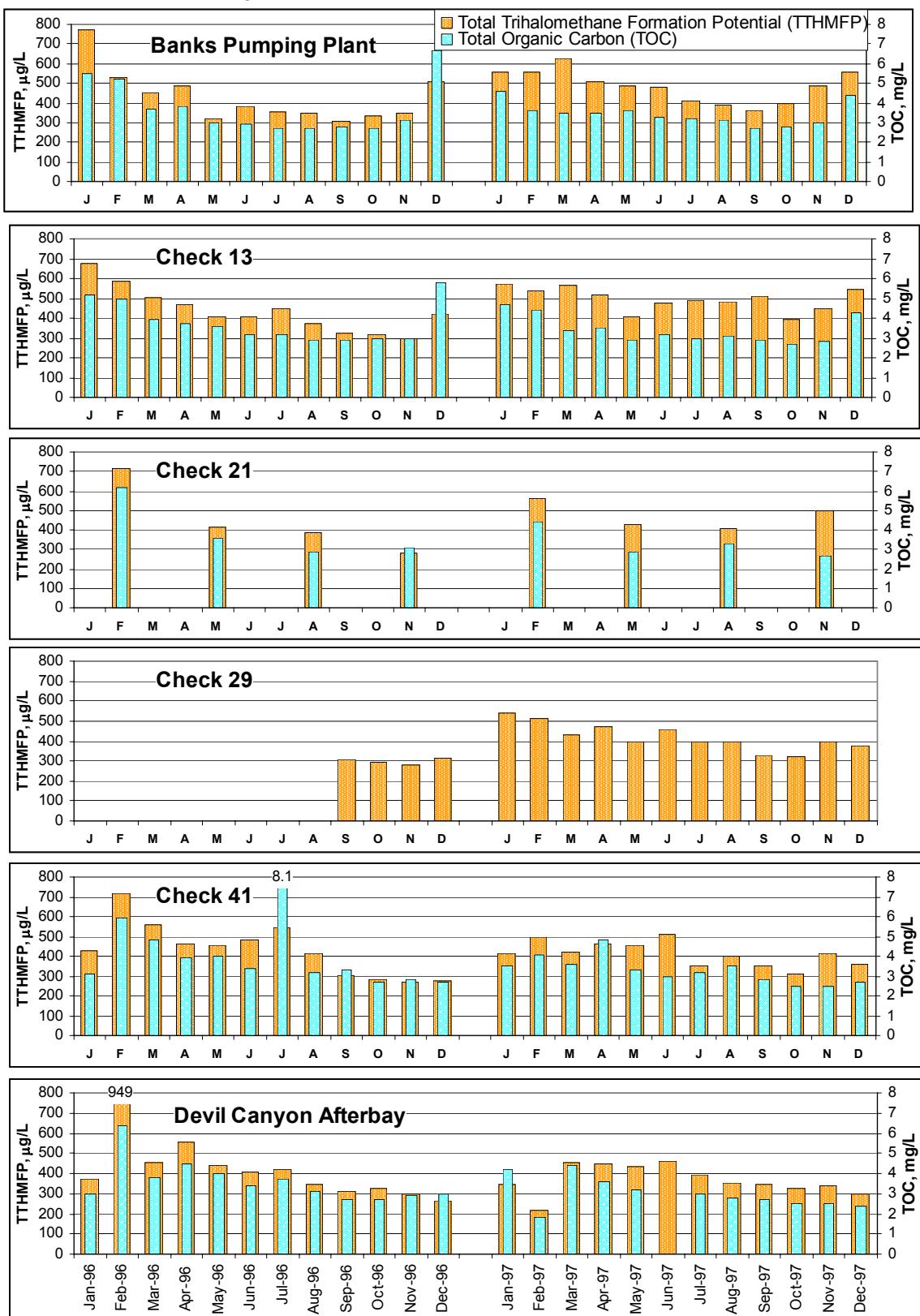
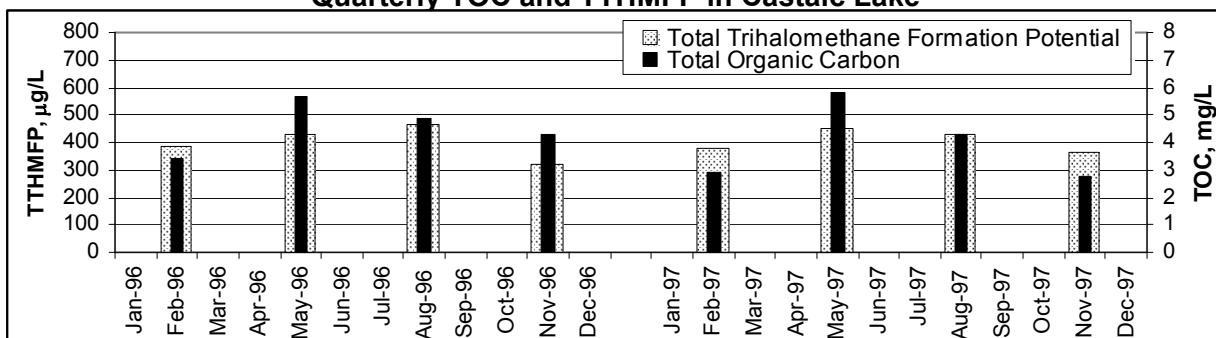


Figure 3-23
Quarterly TOC and TTHMFP in Castaic Lake



Organic Chemicals

Organic chemicals include insecticides, herbicides, petroleum compounds, and other synthetic chemicals. The chemicals analyzed in each sample are listed in Appendix A. All were below their reporting limits except those in Table 3-14, and all of those were below their respective MCLs for finished drinking water. Most were pesticides except several positives for MtBE (methyl tertiary-butyl ether), a gasoline additive. Although all MtBE values in Table 3-14 were below the Secondary MCL of 0.005 mg/L, more intense monitoring has shown the presence of higher levels at Project lakes in Southern California (DWR 1999).

Insecticides and herbicides were detected throughout the California Aqueduct on 10 occasions during 1996-97. The pesticides probably originated from the Delta via Banks Pumping Plant or the Delta-Mendota Canal because, on all occasions, they were detected either at Banks Pumping Plant, the DMC, or Check 13. The only other major potential source of pesticides to the Aqueduct is floodwater inflows in the SLC located downstream from all three stations (DWR, 1995).

The herbicides cyanazine, Dacthal, diuron, and simazine were detected throughout the Aqueduct in March 1996. All but simazine are pre-emergent herbicides used prior to planting or for weed control in fallow fields. Herbicides were also detected Aqueduct-wide in September and June 1996. During 1997, the herbicides 2,4-D and cyanazine were detected throughout most of the Aqueduct on two occasions; 2,4-D was detected in September at three stations from Check 13 to Check 29, and cyanazine was detected Aqueduct-wide in March 1997.

The only insecticide detected Aqueduct-wide was diazinon. Diazinon is frequently applied to stone fruit orchards between late winter and spring to prevent bud predation. The pesticide was detected throughout the Aqueduct in March and June of 1997. The insecticide phosalone was detected at the reporting level of 0.02 ug/L at Check 13 in June 1996.

In the North Bay Aqueduct, the insecticides chlorpyrphos and aldicarb were detected once each in March and June 1996, respectively. Cyanazine was detected several times during 1996-97, and Dacthal was detected in March 1996.

Table 3-14
Insecticides, Herbicides, and Organic Chemicals in the State Water Project, 1996-97
(Reported in µg/L)

- = Below the Reporting Limit				California Aqueduct													
Chemical	R.L. 1/ MCL	Barker Sl.		Banks		Check 13		Check 21		Check 29		Check 41		Devil Can- yon A.B.		DMC(CVP)	
		P.P. 1996	P.P. 1997	P.P. 1996	P.P. 1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997	1996	1997
2,4-D	0.1	70	March	-	-	0.33	-	-	-	-	-	-	-	-	-	-	0.13
			June	-	-	-	-	-	-	0.12	-	-	-	-	-	-	-
			September	-	-	0.33	-	0.24	0.38	0.15	0.16	0.25	0.12	0.33	-	0.15	0.29
Aldicarb	2		March	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			June	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-
			September	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chlorpyrphos	0.01		March	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
			June	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			September	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cyanazine	0.01		March	-	0.03	-	0.07	0.12	0.09	0.14	0.07	0.17	0.04	0.19	0.02	-	0.01
			June	0.21	-	-	-	-	-	0.02	-	-	-	-	0.02	-	-
			September	0.02	-	-	-	-	-	-	-	-	-	-	-	-	-
Diazinon	0.01		March	-	-	-	-	0.02	-	0.04	-	0.03	-	0.03	-	-	-
			June	-	-	-	-	0.02	-	0.01	-	0.02	-	0.01	-	-	0.03
			September	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dacthal (DCPA)	0.01		March	0.05	-	0.05	-	0.07	-	0.07	-	0.08	-	0.06	-	0.06	-
			June	-	-	-	-	-	-	0.01	-	0.01	-	-	-	-	-
			September	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Diuron	0.05		March	-	-	0.18	-	0.55	-	0.61	-	1.14	-	1.78	-	0.26	-
			June	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			September	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosalone	0.02		March	-	-	-	-	-	-	-	-	-	-	-	-	-	-
			June	-	-	-	-	0.02	-	-	-	-	-	-	-	-	-
			September	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Simazine	0.02	4	March	-	0.06	0.07	0.05	0.09	0.03	0.16	-	0.31	-	0.38	-	0.08	0.05
			June	-	-	0.03	-	0.08	-	0.19	-	0.26	0.06	0.23	-	0.17	-
			September	-	-	-	-	-	0.13	-	-	-	0.02	-	0.05	-	-
MtBE	0.1		March	-	-	-	-	-	0.5	-	-	-	-	-	-	-	-
			June	-	-	-	1.8	-	-	-	-	-	-	-	-	4.0	-
			September	-	-	-	1.7	-	-	-	-	-	-	-	-	2.3	-

1/ Reporting Limit

Effects of Dredging on San Luis Canal Water Quality

Dredging was conducted in the California Aqueduct during 1996 to remove sediment deposited by floodwaters the previous year. Sediment was dredged using a low-profile cutter head that hydraulically suctioned material onto land west of the levee. Three locations were dredged: (1) between mileposts 153.3 and 155.6; (2) around milepost 135 (just downstream from the Cantua Creek drain inlet); and (3) around the Arroyo Pasajero levee break at milepost 157.4. Volume estimates based on acoustic sounding and manual pole measurements indicated between 28,000 to 33,000 cubic yards of sediment were to be removed.

The Surveillance and Monitoring Unit initiated sampling for any potential water quality effects. Sequential upstream and downstream samples were collected and analyzed for a full suite of water quality parameters. More intensive monitoring was performed for turbidity during the first 10 days of dredging. Analysis of the data indicates that no substantial changes in Aqueduct water quality occurred as a result of dredging.

Dredging was initiated on May 5 at milepost 153.3. During the first 10 days of dredging, turbidity was measured at four stations every 6 hours when the dredge was active—one upstream of the dredger and three downstream at intervals of 100, 200, and 300 feet. Turbidity at each station was measured at 10 and 20 foot depths to account for heavier particulates transported near the bottom and lighter particulates higher in the water column. Multiple samples were needed to offset the inherent variability of turbidity measurements in flowing water.

Average daily turbidity along with standard deviation limits for depth measurements at 10 feet are plotted in Figure 4-22 (upper graph). From May 5 to 7, daily turbidity averaged between 7 and 9 NTU. Between May 8 and 11, it increased at both upstream and downstream stations. On May 8, the average turbidity was 13 NTU at the upstream site and around 15 NTU at the three downstream sites. The variability of all sample groups was high. For instance, standard deviation at the 300-foot downstream site ranged from 10 to 20 NTU. On May 9, the average turbidity at the upstream site (16 NTU) was the same as the 100-foot downstream station, lower than the 200-foot downstream site (17 NTU), and higher than the 300-foot downstream site (12 NTU). On May 11, the upstream turbidity (13 NTU) was equal to two of the downstream sites and higher than the 300-foot downstream station (10 NTU). Between May 12 and 13, average turbidity levels declined to 6 or 7 NTU. On May 12, turbidity at the upstream site averaged higher than the two other downstream sites, and on May 13, all averages were either 6 or 6.5 NTU. Turbidity began increasing on May 14. On May 15, turbidity averaged 17 NTU at the upstream site, 100-foot downstream, and 300-foot downstream stations, and 14 NTU at the 200-foot downstream station.

Trends in average daily turbidity at the 20-foot depth were similar but slightly higher; they ranged between 7 and 25 NTU (Figure 4-22, lower graph). The large degree of variability in the turbidity measurements hindered any high-resolution analysis of potential upstream/downstream differences. Although upstream turbidities sometimes averaged lower than downstream measurements during the same day, the reverse also occurred. Similar to the 10 feet measurements, multiple measurements taken on the same day were highly variable. The high variability at both depths was not related to dredging activities but to hourly flow changes.

Flows at Check 18 (mp 143) ranged between approximately 2,000 cfs and 8,000 cfs between May 1 and 15. Each time flow increased at Check 18, a corresponding increase in turbidity was observed several hours later at Check 21 (Figure 4-23). The increase in turbidity with flows is a result of in-canal turbulence that resuspends sediment and produces localized plumes of higher turbidity.

Figure 4-22
Turbidity in the San Luis Canal Upstream and Downstream of Dredging Activities

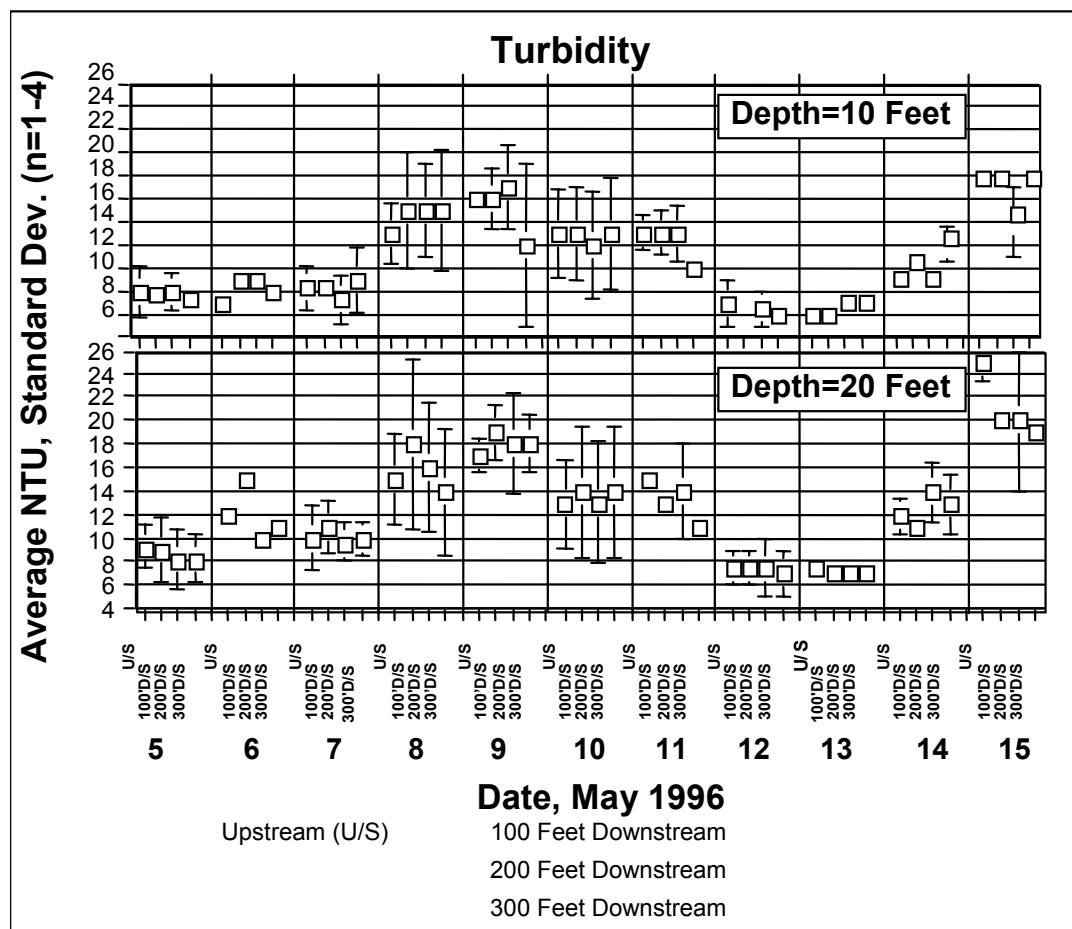


Figure 4-23
Hourly Aqueduct Flows at Check 18 and Turbidity at Check 21, May 1-15, 1996

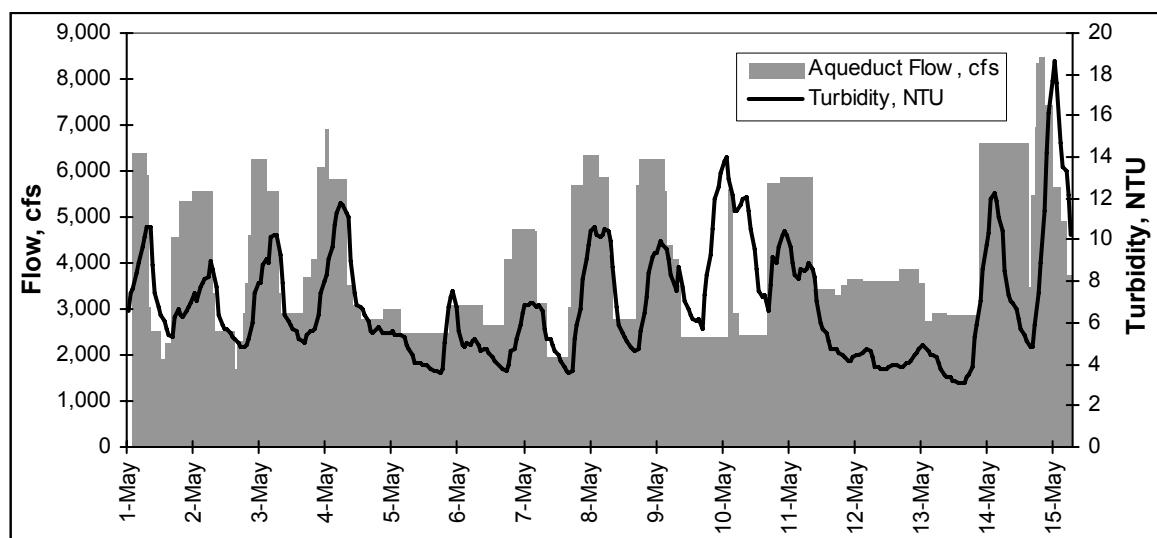
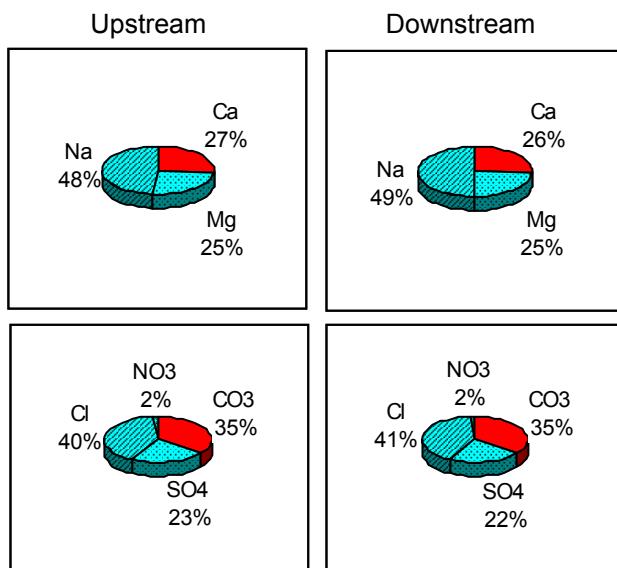


Figure 4-24 shows that anion and cation values on June 10, 1996, were nearly identical between upstream/downstream stations, indicating no change in dissolved minerals from dredging.

Figure 4-24
Anionic/Cationic Values between Upstream and Downstream Stations
in the San Luis Canal, June 10, 1996



Most conventional parameters were similar in concentration between the upstream/downstream stations (Table 4-7). A slight increase in the concentration of suspended particles may have occurred from dredging, but all suspended particulate trends were overshadowed by fluctuations caused by flow. No substantial differences in minor element levels were observed between upstream and downstream sites (Table 4-7).

Five EPA organic chemical scans were performed on samples collected on May 6 and June 10, 1996. On May 6, upstream/downstream sampling occurred at milepost 135.42 and milepost 153.42. Of the five scans, Dacthal was detected both above and below the dredging operation (Table 4-7). On June 10, upstream/downstream sampling at mileposts 134.81 and 135.01 detected diazinon (ortho-phosphate) and simazine (chlorinated pesticide) at both stations. The pesticides apparently originated from upstream sources and not as a result of dredging activities.

Total asbestos was slightly lower at the downstream station compared to the upstream site. The reverse was true for the concentration of asbestos fibers greater than 10 microns in length. Since asbestos is affected by turbidity and can be just as variable, the differences are not necessarily significant.

Total coliforms averaged higher at the downstream location, but the difference, 40 MPN/100 mL at the downstream site versus 26 MPN/100 mL upstream, was not statistically significant. Of the 11 samples collected during dredging, approximately half of the total coliform results were higher at the upstream site. The likely explanation for the upstream/downstream difference is analytical imprecision. The multiple tube fermentation test used to detect and quantify coliforms provides an estimate with wide confidence limits that is not designed to be an absolute population value. Fecal coliform levels were 11 and 16 MPN/100 mL at the upstream and downstream sites, respectively. Similar to total coliform, fecal coliform averaged higher at the downstream site compared to upstream; however, the difference was not statistically significant.

Table 4-7
Summary of Water Quality Parameters in the SLC Upstream and Downstream
Dredging Activities, June 1996

Parameter	Units	Upstream	Downstream	# of Samples
Conventional Parameters				
pH	pH	7.3	7.4	1
TDS	mg/l	202	204	1
EC	µS/cm	357	362	1
Boron	mg/l	0.2	0.2	1
Hardness	mg/l as CaCO ₃	86	84	1
TOC	mg/l	3.6	3.5	2
TSS	mg/l	6.5	8	2
VSS	mg/l	3	3.5	2
SS	mg/l	<0.1	<0.1	2
Minor Elements				
Arsenic	mg/l	0.002	0.002	1
Barium	mg/l	<0.050	<0.05	1
Cadmium	mg/l	<0.005	<0.005	1
Chromium	mg/l	<0.005	<0.005	1
Copper	mg/l	<0.005	<0.005	1
Iron	mg/l	0.008	<0.005	1
Lead	mg/l	<0.005	<0.005	1
Manganese	mg/l	<0.005	<0.005	1
Mercury	mg/l	<0.001	<0.001	1
Selenium	mg/l	<0.001	<0.001	1
Silver	mg/l	<0.005	<0.005	1
Zinc	mg/l	<0.005	<0.005	1
Asbestos				
Asbestos, total	MFL a	304	267	2
Asbestos, fibers >10 um	MFL a	2.3	1.78	2
Organic Chemicals				
Ortho-phosphates	µg/l	Diazinon (0.02)	Diazinon (0.02)	2
Chlorinated organics	µg/l	Simazine (0.1-0.19)	Simazine (0.1-0.19)	2
	µg/l	Diuron (0.19)	Diuron (0.12)	2
Chlorinated Phenoxy	µg/l	Dacthal (0.11)	Dacthal (0.10)	2
Miscellaneous	µg/l	None	None	2
Purgeables	µg/l	None	None	2
Coliforms				
Total	MPN/100 L b	26*	40*	11
Fecal	MPN/100 L b	11*	16*	11

a Million fibers per Liter.

b Most probable number per 0.1 Liter.

* Upstream and downstream averages not statistically different at 95% confidence level.

Oil Release in the California Aqueduct

On August 9, 1997, a small portion of Aqueduct liner slumped into the water at milepost 62.23 (near Butts Road). Adjacent groundwater pressure, problematic geology, and a partial de-watering of the Aqueduct for repairs caused the slippage. Oil was observed in the Aqueduct, and flows were stopped until it could be contained. The slippage occurred where an oil pipeline crosses the Aqueduct; however, the pipeline was inactive at the time, so investigators presumed the oil was residual, remaining from a leak that occurred in 1984. A pressure test of the line found no leaks and confirmed it. The 1984 leak was discovered when tainted groundwater began discharging from a Project sump pump 0.16 mile downstream from the pipe. Although soil and groundwater were cleaned up at that time, some residual contamination remained.

Civil Maintenance staff immediately placed sorbant booms in the Aqueduct around the slippage to prevent further oil migration. Booms were also deployed at several downstream locations. Oiled booms were removed and disposed of as needed. Emergency repairs were made and Aqueduct flows resumed on

August 14—five days after the slippage was discovered. The booms remain in place as of this publication date to prevent any residual oil from flowing into O'Neill Forebay, approximately 5 miles downstream.

Daily sampling in the Aqueduct was initiated by Surveillance and Monitoring staff on August 11 at three locations—two stations immediately adjacent the slippage and one downstream at milepost 63.32. As cleanup progressed, one upstream station was added and downstream stations were added or deleted as necessary. Samples were analyzed for purgeable organics, including benzene, toluene, ethyl-benzene, and xylene, as well as total petroleum hydrocarbons (diesel-grade fuel).

Purgeable organics were detected in the Aqueduct on a daily basis up until August 15—one day after flows resumed. Maximum concentrations ranged from 0.58 to 4.7 µg/L, depending on constituent and sample site. One sample collected on August 14 at milepost 62.26 contained benzene at 2.2 µg/L, above the state MCL of 1 µg/L. All other samples contained purgeable organics below their respective MCLs. Total petroleum hydrocarbon analyses were above the reporting limits at three downstream locations on August 15, 19, and 20, including a positive at the upstream site on August 19 indicating the possibility of sample contamination. No criteria or objective exists for TPH. Monitoring for purgeable organics and TPH continued into October with no positive detections.

The site was remediated by excavating tainted soil and treating the surrounding groundwater. Overburden was removed and stored on the Department's right-of-way land until petroleum levels could be determined for future removal and disposal. A physical barrier was installed to intercept any further movement of groundwater toward the Aqueduct.

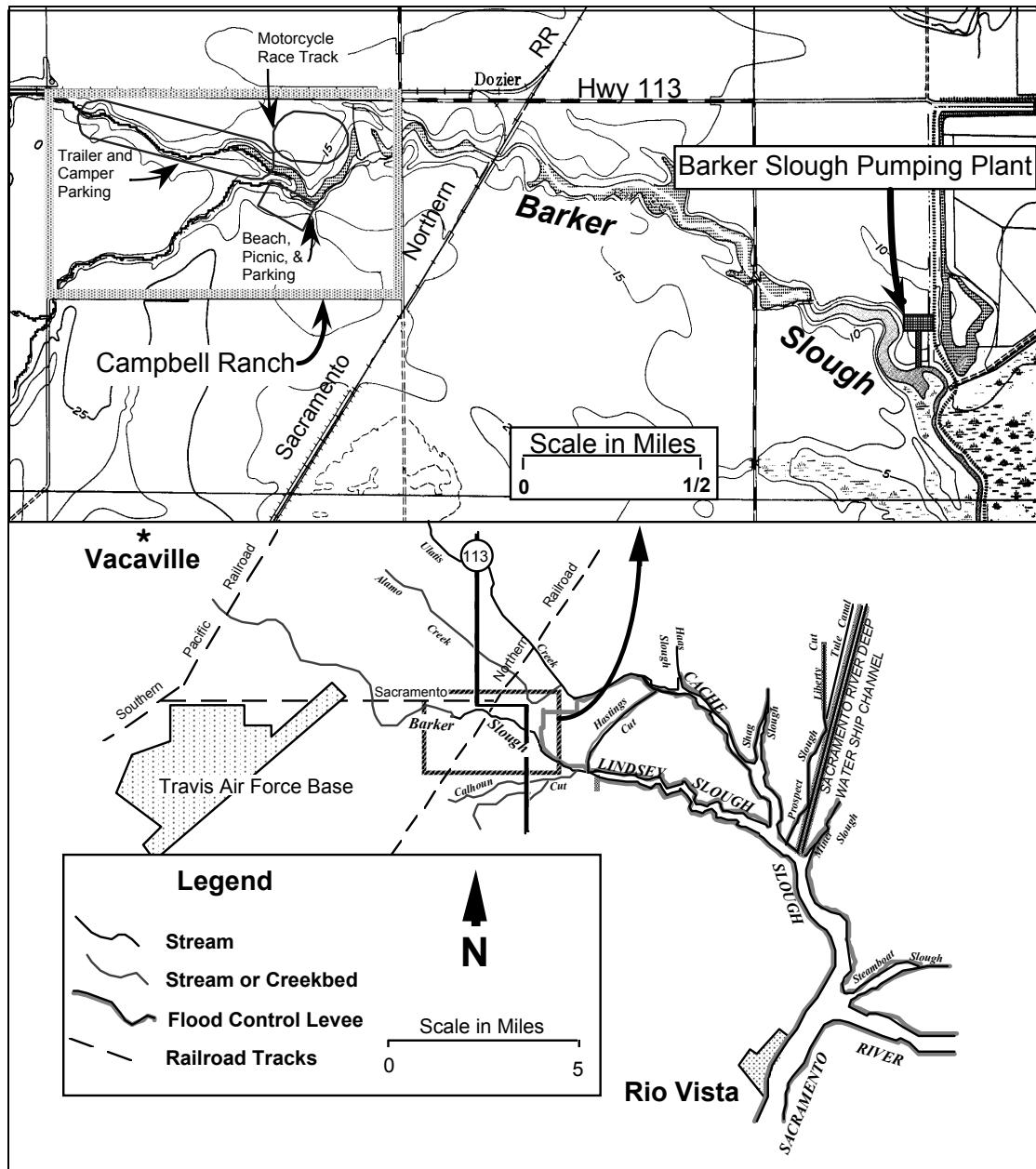
An existing treatment plant (installed in 1985 and operating as of this publication date) removes any hydrocarbons and discharges the clean water over the Aqueduct. A series of pumps skim water from the aquifer surface and send it to an oil/water separator to recover free product. The water is then passed through granular activated carbon to remove any remaining hydrocarbons. Pumpage from a nearby departmental sump pump is also intercepted and treated. Treated water is piped to an overchute and diverted over the Aqueduct to a seasonal streambed. The treatment plant will continue to operate until the site is fully cleaned up.

Water Quality Assessment of the North Bay Aqueduct

Water treatment plants on the North Bay Aqueduct periodically experience surges of total organic carbon in their raw water. These surges sometimes increase to over five times background levels and interfere with the water treatment process. Background TOC levels at Barker Slough Pumping Plant, the entrance to the North Bay Aqueduct (Figure 4-25), range between 3 to 6 mg/L during the summer but can increase to over 20 mg/L during the rainy season. For comparison, levels at Banks Pumping Plant in the south Delta typically range between 3 and 9 mg/L. Raw water with high organic carbon requires special treatment to limit the formation of trihalomethanes in drinking water. Trihalomethanes can be carcinogenic, and the Department of Health Services will be lowering the human health standard for these compounds in drinking water. The water treatment plants will have to comply. Data was analyzed to define the seasonal trends of TOC and other parameters that change with rainfall runoff in Barker Slough.

Water in Barker Slough originates from an upstream watershed that is approximately 15 square miles in size. Depending on season, 60 to 80 percent of the watershed is used for animal grazing such as cattle (DWR 1998). The remainder is largely agricultural and open space, with a small recreational park that offers watersports and a dirt track.

Figure 4-25
Barker Slough and Barker Slough Pumping Plant in the Northern Sacramento-San Joaquin Delta/Estuary



TOC Trends

Figure 4-26 shows TOC is highest during the rainy season months of December through March. It also shows that TOC increased during or just after major rainfall events and stayed elevated with continued seasonal rainfall. In 1991 and 1994, annual precipitation was less than 14 inches and TOC exceeded background levels on only a few occasions (Figures 4-27 and 4-28). Conversely, during years of high rainfall (15-29 inches), levels remained elevated for several months at a time. During the 1996 rainy season, an intense early season storm dropped 7 inches over 2 consecutive days. Soon after, TOC at Barker Slough Pumping Plant increased to 18 mg/L and stayed elevated until mid-April, as rain continued to fall throughout the season (Figure 4-28). Major TOC sources in Barker Slough have not been

Figure 4-26
Total Organic Carbon in the North Bay Aqueduct and Monthly Rainfall at the City of Fairfield, October 1989 to October 1996

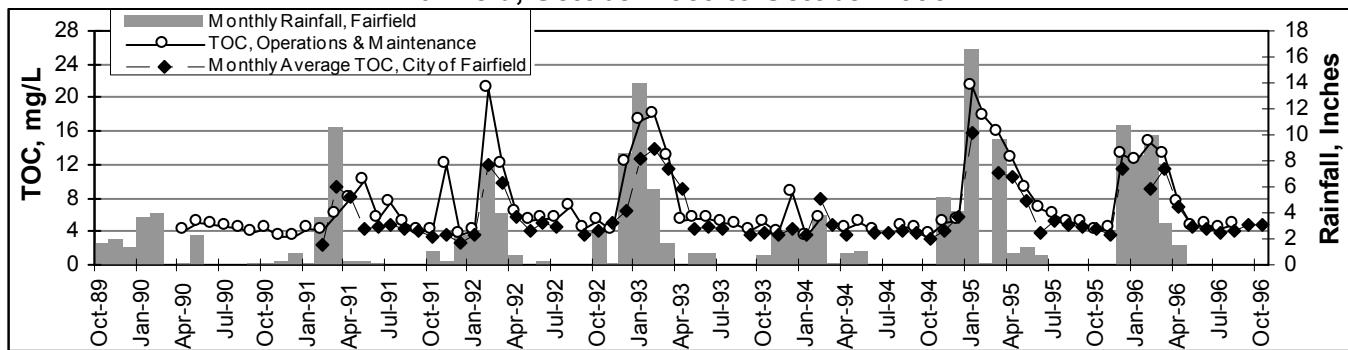


Figure 4-27
Total Organic Carbon in the North Bay Aqueduct and Rainfall in the City of Fairfield, 1991-93

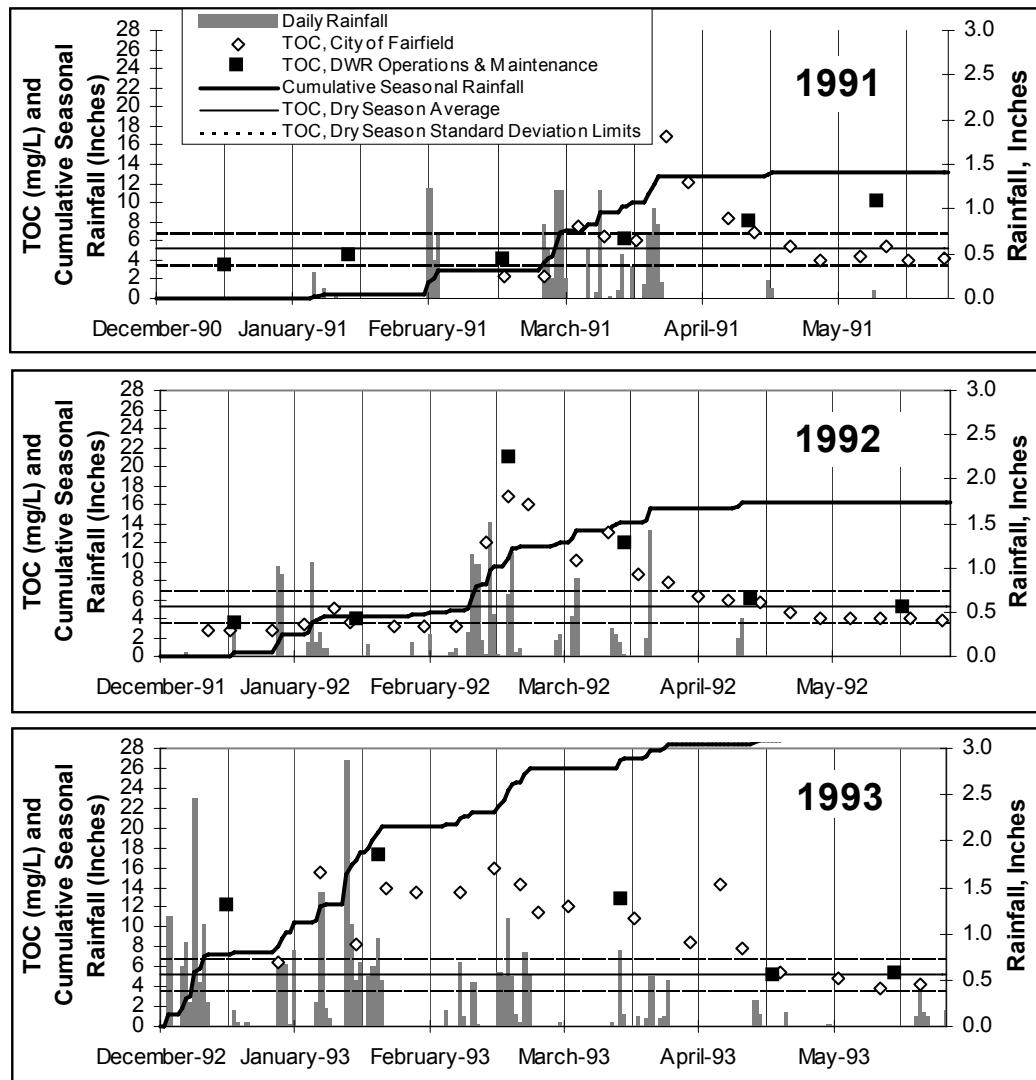
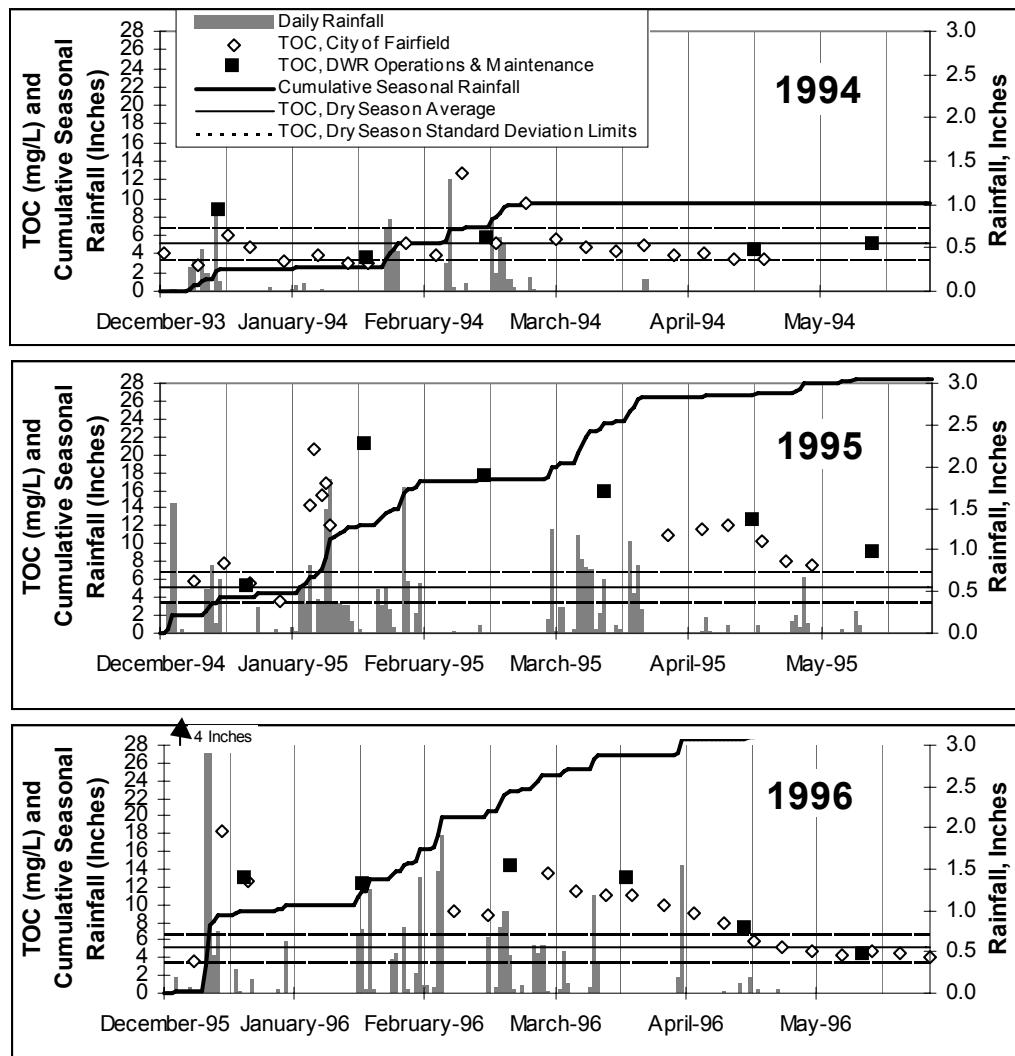


Figure 4-28
Total Organic Concentrations in the North Bay Aqueduct and Rainfall in the City of Fairfield, 1994-96



conclusively identified, but preliminary data indicates that peat soils and animal waste are probably two contributors.

TOC concentrations were not correlated with absolute rainfall totals since runoff from any undeveloped watershed depends on both rainfall intensity and soil saturation. Table 4-8 shows this relationship for Barker Slough. During each of the 1991-96 rainy seasons, TOC increased above background levels when seasonal rainfall totals reached 2.3 to 9 inches. During years when there was no intense rainfall, elevated TOC was first detected when the seasonal total was around 7 inches. Evidently, this is the amount of rainfall needed to saturate soil in the watershed and produce runoff. When seasonal rainfall totals were less than 7 inches, rainfall intensity generated runoff with high TOC. In 1994, for instance, seasonal cumulative rainfall at the time of the first elevated TOC sample (9 mg/L) was only 2.3 inches, while rainfall during the 3-day period prior to sampling totaled 0.98 inches. This trend occurred again in 1995 when 0.77 inches fell within a 3-day period with only 4 inches of seasonal rainfall (Table 4-8).

Table 4-8
Cumulative Seasonal Rainfall and Rainfall 3 Days Prior to the First Season's Elevated TOC Concentration at Barker Slough Pumping Plant, 1991 to 1996

Water Year	Elevated TOC		Rainfall 3 Days Prior to Elevated TOC	Day of Sample Since Recorded Rainfall
	Date Detected	Conc. mg/l		
1991	8-Mar	8	7.11	0
1992	14-Feb	12	7.5	1.24
1993	16-Dec	12	7.25	0
1994	15-Dec	9	2.34	4
1995	16-Dec	8	4.11	0.98
1996	15-Dec	18	8.86	0.77
				1
				1

Coliforms

Coliform bacteria were also highest during the rainy season. From 1992 to 1996, total coliforms ranged from <2 to 5,500 MPN/100 mL (Figure 4-29) and fecal coliforms ranged from <10 to 5,500 MPN/100 mL (Figure 4-30). The highest levels were observed just before or during periods of substantial rainfall in the City of Fairfield. Pre-rainfall increases are thought to originate from increased outflows from an upstream reservoir. In the fall, flashboards are removed by the owner to drain the lake and increase storage capacity. These releases may be scouring the bottom of the lake and resuspending any settled coliforms.

Total and fecal coliform values were correlated in the high range (Figure 4-31, bottom left graph). This was not the case for coliforms at Banks Pumping Plant or in the Sacramento River. Although many different strains of bacteria are present in the environment, only fecal coliforms are enteric or can survive within the intestinal tract of mammals. The correlation indicates that most coliforms transported downstream via rainfall runoff originated from animal waste. Although coliforms are easily destroyed in the water treatment process, products of animal waste can also contain parasites such as *Cryptosporidium* and *Giardia*, which are not so easy to destroy in the water treatment process. These two organisms are known to cause intestinal sickness and even death if ingested by humans. Although water quality data on these two parameters exists, the method for analysis is not considered reliable.

Figure 4-29
Total Coliforms and Daily Rainfall at Barker Slough Pumping Plant, 1992-96

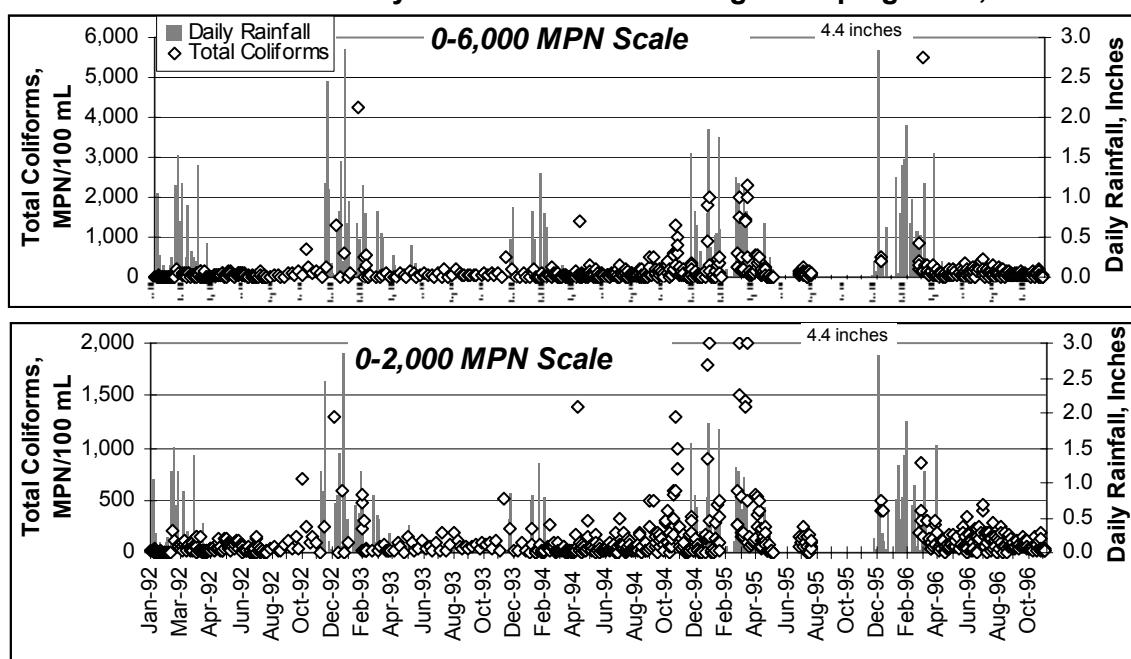


Figure 4-30
Fecal Coliforms and Daily Rainfall at Barker Slough Pumping Plant, 1992-96

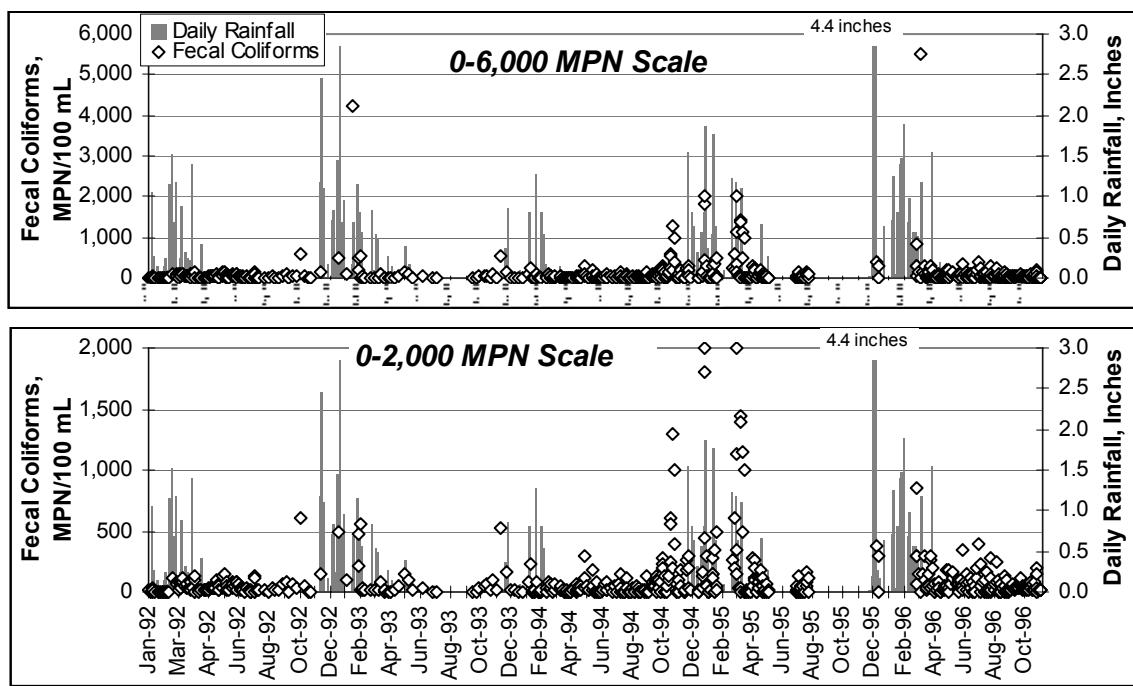
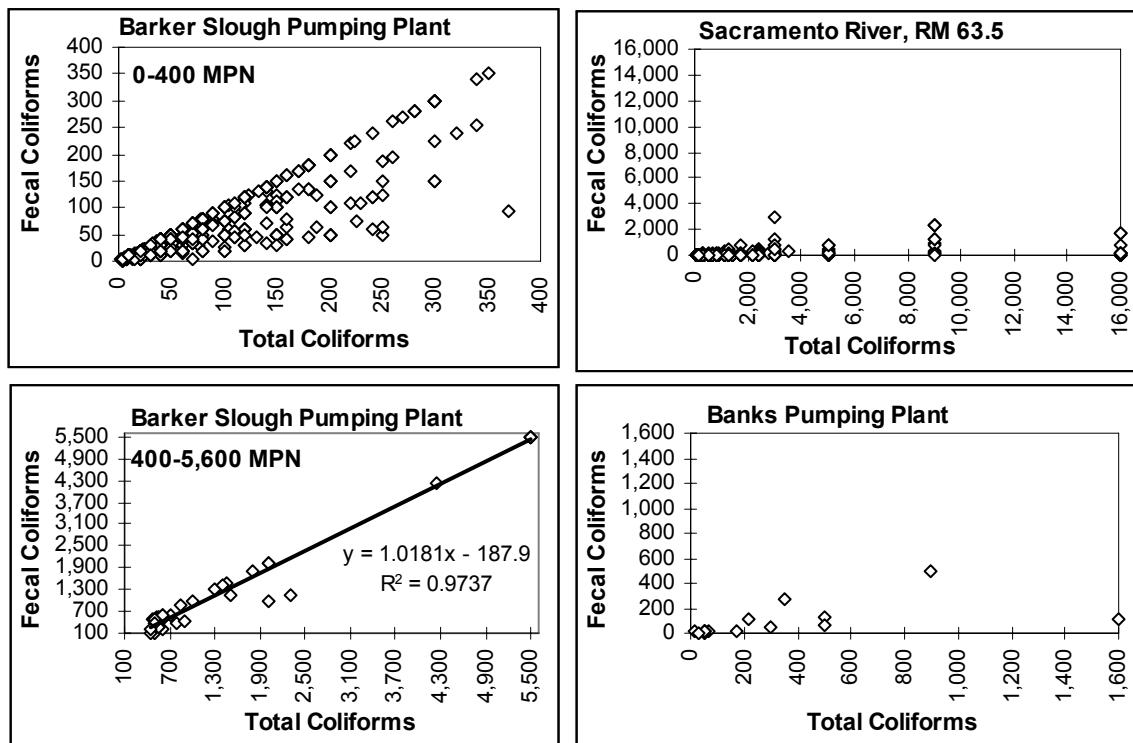


Figure 4-31
Total and Fecal Coliform Relationships at Barker Slough Pumping Plant, Sacramento River at the City of West Sacramento Water Treatment Plant, and Banks Pumping Plant (MPN/100 mL)



Other Parameters

Temperature, nitrogen compounds, pH, and certain metals in Barker Slough also fluctuated seasonally between 1992 and 1996. Monthly water temperatures at Barker Slough Pumping Plant varied annually by as much as 15 degrees, ranging from 8 degrees Celsius in fall and winter to more than 25 degrees Celsius during the summer (Figure 4-32, top graph). Temperature declined each fall prior to any rainfall and then reached a seasonal minimum, usually between December and February. The lowest temperatures occurred during periods of rainfall.

Although the data is not extensive, nitrogen compounds also fluctuated seasonally and increased during periods of rainfall. For instance, organic nitrogen and dissolved ammonia peaked in December 1995 after 2 days of heavy rainfall (Figure 4-32). These compounds remained elevated through January and March 1996, with continued on-and-off rainfall. Organic nitrogen is defined as organically-bound nitrogen and includes compounds such as proteins, peptides, nucleic acids, urea, and other organics present in animal excreta (as is ammonia). TOC was correlated with this compound but not nitrate (Figure 4-33). Nitrate in surface waters can originate from a number of sources including animal waste, fertilizers, and nitrification. Nitrates are also more likely to percolate through soil than organic nitrogen, reducing the amount available for transport via runoff.

Background pH ranged between 7.5 and 8.5 during the summer months, but declined below 7.5 for several months during the rainy seasons of 1993, 1995, and 1996 (Figure 4-32). The declines were likely caused by rainfall runoff. When rainfall—commonly exhibiting pHs below 6—is substantial enough, the increased acidity in runoff may be enough to overwhelm the buffering capacity of the watershed. The ammonium ion (NH_4^+), a weak acid, may also have a measurable effect on pH. Regardless of the source of acidity, pH declines can increase the solubility of waterborne metals.

Dissolved aluminum and iron often increased with a corresponding decrease in pH (Figure 4-32). The high levels are not necessarily a result of augmentation from the watershed, because the solubility of most metals is controlled more by physicochemical parameters such as temperature and pH. A more probable cause of the high iron and aluminum levels is that more of the available metals were solubilized when pH dropped.

Standard solubility relationships for iron predict a dissolved concentration of 0.006 mg/L in a pH range from slightly more than 7 to 11 (Hem 1985). However, when pH falls below about 7.2 (or increases above 11), the solubility of iron is highly dynamic. For instance, when pH decreases from 7 to 6.5, the solubility of iron is predicted to increase three orders of magnitude from 0.006 to 6 mg/L, assuming standard state conditions and an excess of available iron. This relationship was observed at least once at Barker Slough Pumping Plant. During 1993, pH declined to 6.9 in January, and the corresponding iron concentration increased from near 0.005 mg/L to 0.61 mg/L. Aluminum concentrations essentially mimicked those of iron during the 1993 rainy season, although during other rainy seasons, iron usually peaked at a higher level. The pH declined just as dramatically during subsequent rainy seasons, but increases in dissolved metals were not as great. Different filter types may have caused this discrepancy—cotton-based disk filters were used prior to 1995 and were replaced with polymer-based cartridge filters. In a few instances, metals increased without a corresponding decrease in pH; this may have been due to windblown dust, which is a known source of iron contamination. A detailed study of Barker Slough water quality can be found in DWR 1998.

Figure 4-32
Seasonal Temperature Fluctuations, Nitrogen Compounds, pH, and Certain Metals with Daily Rainfall in the North Bay Aqueduct at Barker Slough Pumping Plant

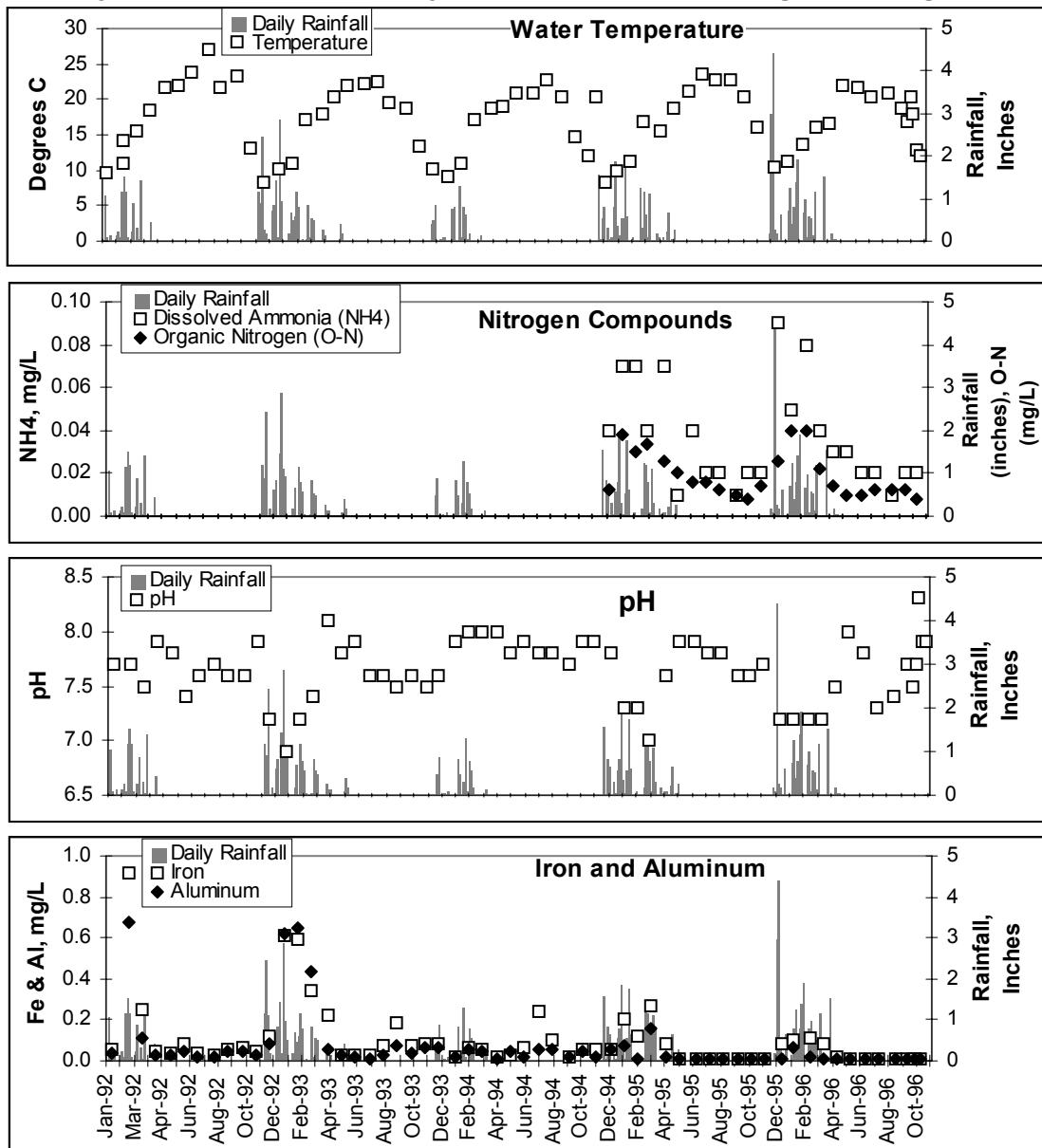
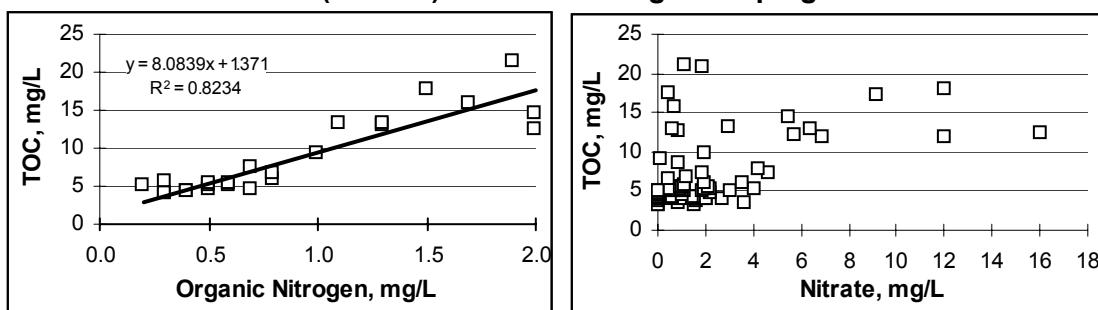


Figure 4-33
Relationship between Total Organic Carbon and Organic Nitrogen and Nitrate (as NO₃) at Barker Slough Pumping Plant



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Appendix A

Methods

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Methods

Monitoring Stations

Water quality samples are routinely collected at 29 stations throughout the State Water Project (Table A-1, Figure A-1, and Plates 1 to 5). Automated water quality monitoring stations measure conventional parameters such as conductivity, temperature, or turbidity at 20 locations throughout the Project (Table A-2, Figure A-1, and Plates 1 to 5).

Water Collection

Water quality sampling, preservation, and transportation protocols were followed as per EPA 1983, USGS 1985, and *Standard Methods for the Examination of Water and Wastewater* (APHA et al. 1995). Specific collection practices varied depending on the site. Water was taken just below the surface at all lake stations, on the Delta-Mendota Canal, and at Thermalito Afterbay and Forebay stations. The collection device is either an acrylic Van Dorn Beta sampler with polypropylene stoppers, hand-dipped bottle, stainless steel bucket for organics, or plastic bucket for metals suspended by a rope.

At sites with automated stations, samples are collected directly from the circulation system. A spigot is opened and runs for 2 to 3 minutes before the bottle is filled. The circulation piping is PVC and the submerged pump forces around 3 to 5 GPM through the system. After the environmental samples and field blanks have been collected, the tubing is removed, rinsed with deionized water, and stored in a ziploc bag.

Filtration of samples is either performed in the field or at the field lab within an hour. At automated station sampling sites, water is filtered directly from the circulation system. A segment of Masterflex platinum-cured polypropylene tubing is connected to the system that is, in turn, connected to a Gelman 0.45 micron filter capsule. One capsule is used for all filtered samples, including the filtered field blanks.

Field blanks for dissolved metals are filtered with a peristaltic pump with the same tubing used for the environmental samples after it has been rinsed with deionized water. To collect field blanks for total metals, the device used to collect the environmental sample (e.g., bucket) is rinsed with deionized water, then filled with deionized water before the field blank bottle is filled. At stations where a sampler is not used, total field blanks are filled with the peristaltic pump setup without a filter. After sampling, the tubing is placed in a ziploc bag for transport and storage. A travel blank is included along with the purgeable organics vials.

All water samples are collected in accordance with the protocol prescribed for the specific method. Further precautions are taken to eliminate sample contamination in the field. These include use of a “clean” sampling box for storage and transport of items used in the filtration process. Clean items include unused filter cartridges, unused sample bottles, filter tubing, and unused baggies. Containers used include coolers with hinged tops or polyethylene security containers with flip lids. Once the samples are collected and filtered, they are placed immediately in a cooler with ice and transported to the lab within 24 hours.

Filtration and processing of samples is conducted on a clean surface. A clean piece of plastic wrapping is often used, as are unused garbage bags that are disposed of after use. The plastic is spread out on the sampling bench prior to sampling. Items set on this surface include sample bottles, filter tubing, preservatives, and unused filter cartridges. The plastic is removed after sample processing and thrown out.

Laboratory Methods

Water quality samples are transported to the Bryte Chemical Laboratory within 24 to 48 hours of collection. Analytical work was performed by Bryte Laboratory using the analytical methods shown in Table A-3. As required for environmental laboratory accreditation in California, Bryte Laboratory filed a Quality Assurance Plan with the California Department of Health Services. The plan covers items required by EPA, such as organization and responsibility, laboratory sample procedures and identification, analytical methods, internal quality control, and corrective action. Internal quality control checks include duplicates, spikes, check standards, reference standards, and control charts.

Table A-1
Water Quality Monitoring Schedule

Waterbody or Facility	Station Name or Description	Station I.D.	Sampling Frequency 1/					Automated Monitoring Station	
			Inorganics	Organics					
Feather River Watershed	Antelope Lake	AN001000	A	A					
	Frenchman Lake	FR001000	A	A					
	Lake Davis	LD001000	A	A	M3				
	Oroville Lake	OR001000		M2					
	Thermalito Forebay	TF001000	Q	Q					
	Thermalito Afterbay	TA001000	M	M2 Q	Q				
North and South Bay Aqueducts	NBA, Barker Sl. Pumping Plant	KG000000	M M M	W1 Q	T T T T T	M4 M4 M4 M4	X		
	NBA, Cordelia Forebay	KG002111	Q Q					X	
	SBA, Check 7	KB001632	M M M				M M	X	
	SBA, Del Valle Reservoir	DV001000	M						
	SBA, Del Valle Res. Outlet	DV000000	M1 M1 M1		M1			X	
	SBA, Santa Clara Terminal Tank	KB004207	Q1 Q1 Q1					X	
California Aqueduct and Coastal Branch	Clifton Court Forebay	KA000000	Q Q					X	
	Banks Pumping Plant	KA000331	M M M M	M	T T T T T	M M		X	
	Check 12	KA006633	Q				Q	X	
	Check 13	KA007089	M M M		T T T T T	M M		X	
	Check 21	KA017226	M M M	M	T T T T T	Q Q		X	
	Coastal Branch	KC000934	M M	M			M	X	
	Check 29	KA024454	M M	M	T T T T T	M		X	
	Check 41	KA030341	M M M M	M	T T T T T	M M		X	
	Check 66	KA040341	Q M	M			Q	X	
	Devil Canyon Afterbay	KA041288	M M M M	Q	T T T T T	M M		X	
San Luis Reservoir and Project Lakes in Southern California	San Luis Res., Trashracks	SL001000	M M M						
	San Luis Res., Tunnel Island	SL005000	M M M					X	
	Pyramid Lake	PY001000	Q Q M						
		PY002000			(Special Monitoring Studies)				
		PY003000			(Special Monitoring Studies)				
	Castaic Lake	CA001000			(Special Monitoring Studies)				
		CA002000	Q Q M					Q Q	
		CA003000			(Special Monitoring Studies)				
	Silverwood Lake	SI001000							
		SI002000	Q Q M						
	Lake Perris	PE001000							
		PE002000	Q Q M						
		PE003000			(Special Monitoring Studies)				
Central Valley Project Delta Mendota Canal		DMC06716	M M		T T T T T M M				

1/ Sampling Frequency : A=Annual Q=Quarterly Q1=Feb, May, Aug-Dec M=Monthly M1=Monthly When Flowing

M2=Apr-Nov M3=May-Sep M4=Weekly in Winter else Monthly, T=Mar, Jun, Sep, W1=Weekly in Winter

2/ Project Standard: Arsenic, Chromium, Copper, Iron, Lead, Manganese, Selenium, Zinc, Calcium, Magnesium, Sodium,

Alkalinity, Sulfate, Chloride, Fluoride, Boron, Nitrate, Dissolved Solids, Turbidity, and Conductivity

3/ Project Additional: Barium, Cadmium, Aluminum, Mercury, and Silver.

Figure A-1
Water Quality Monitoring Stations in the State Water Project

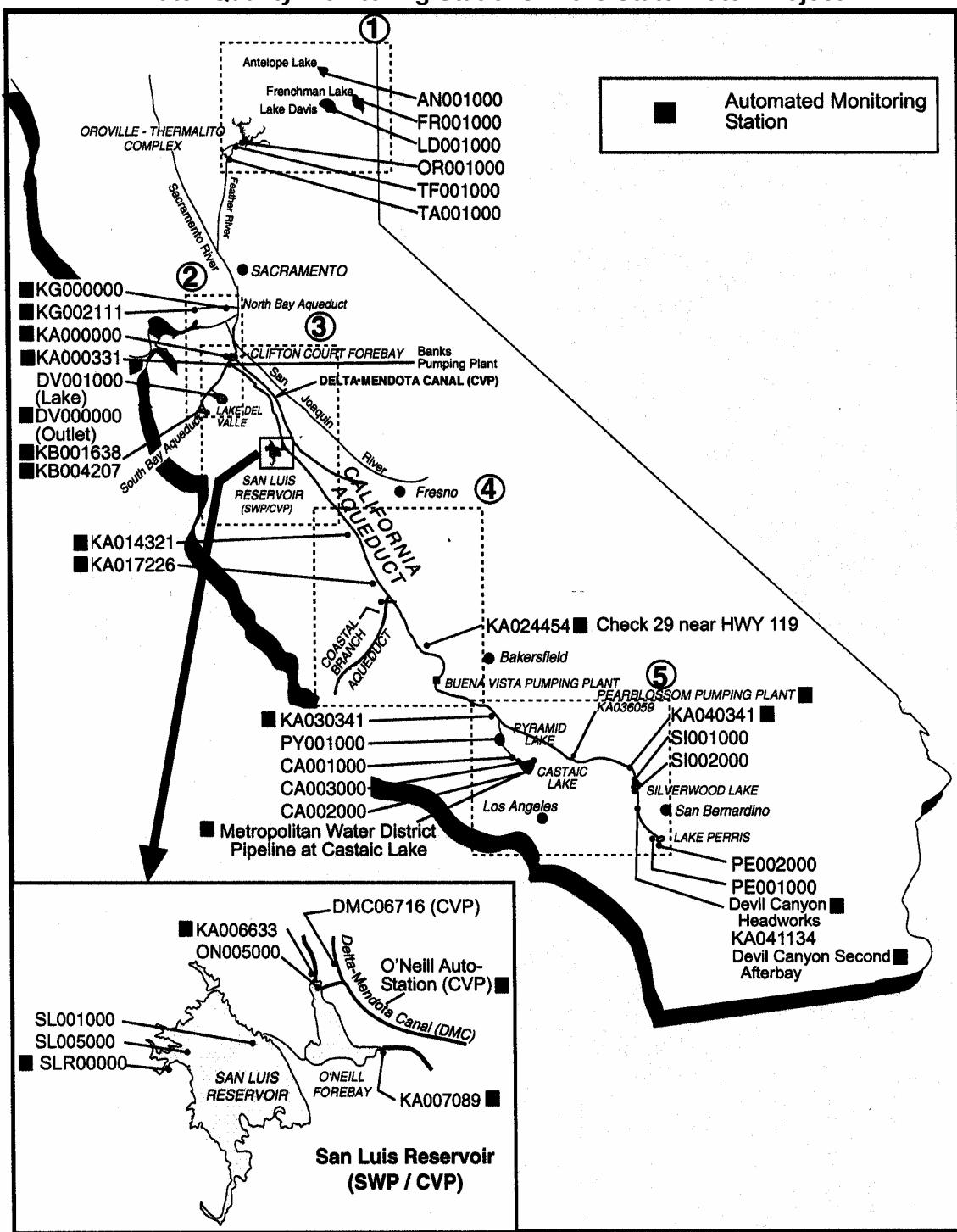


Plate 1

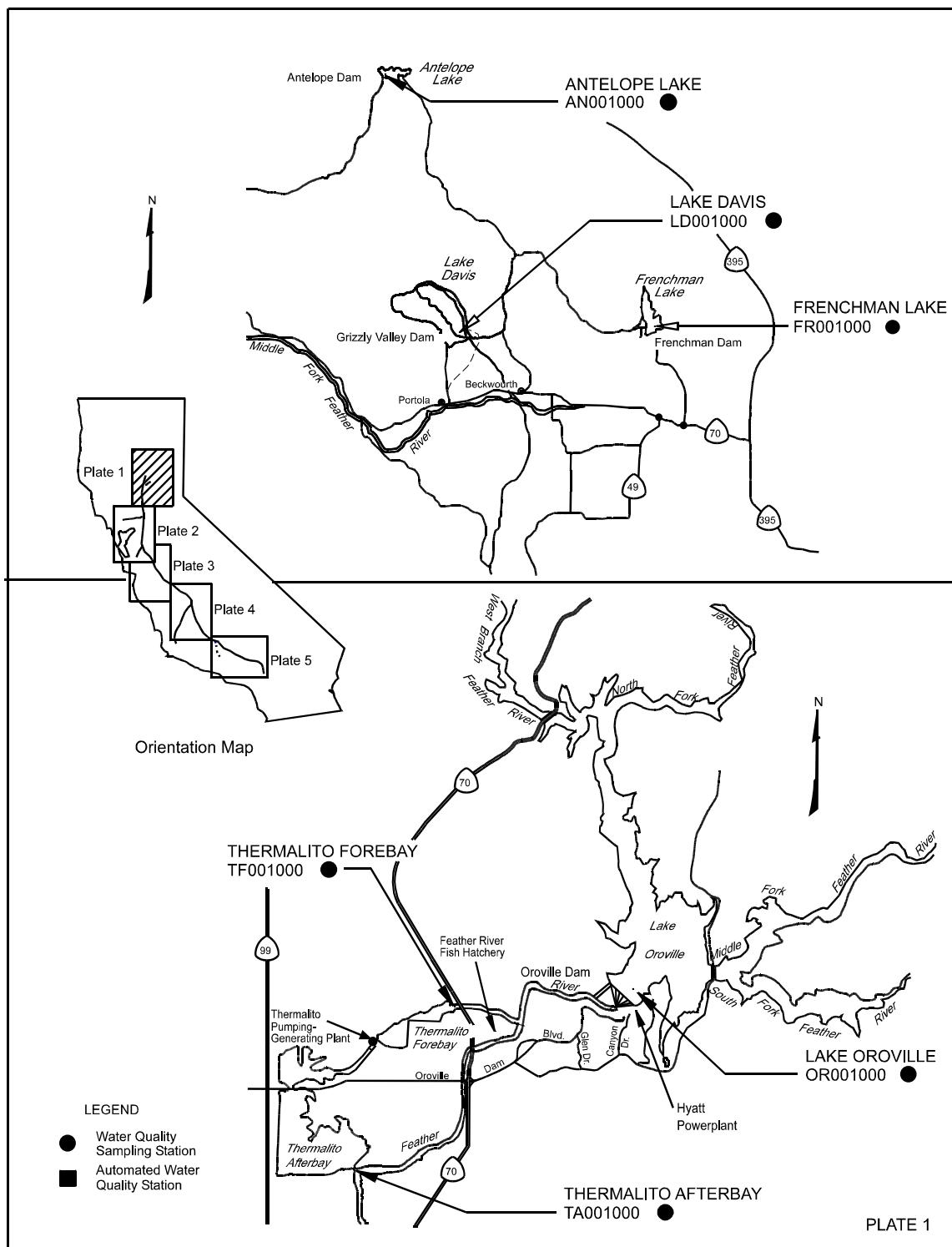


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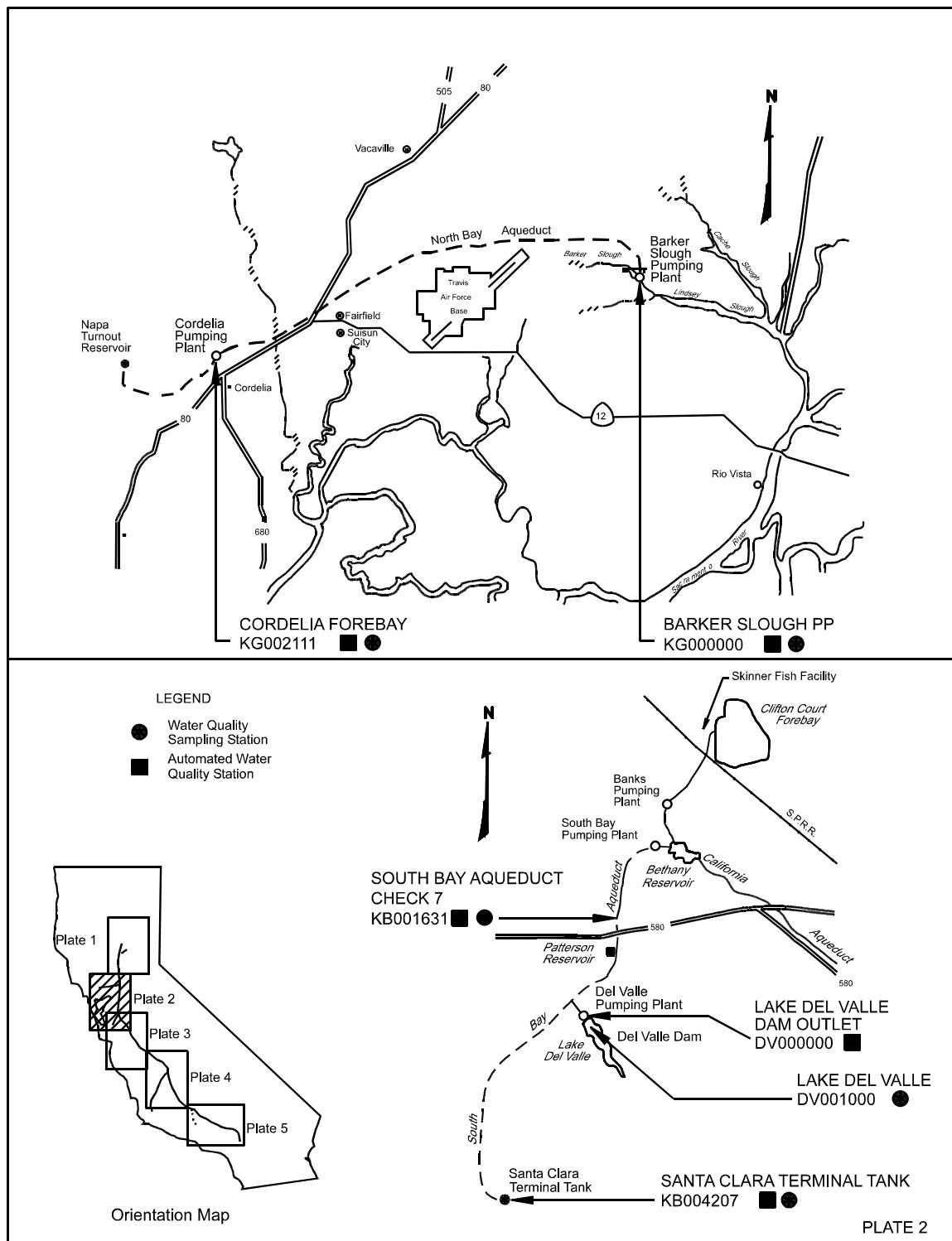


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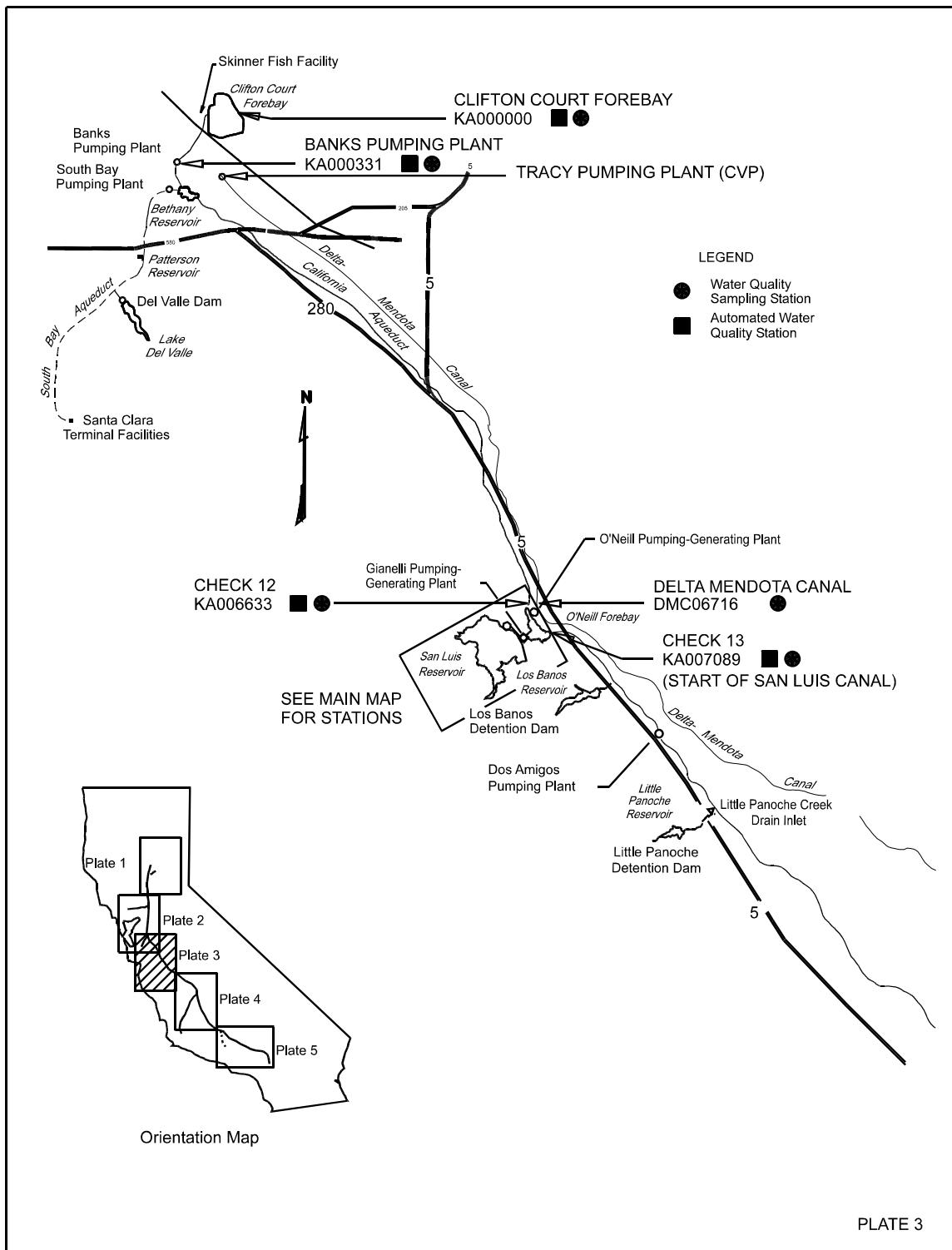


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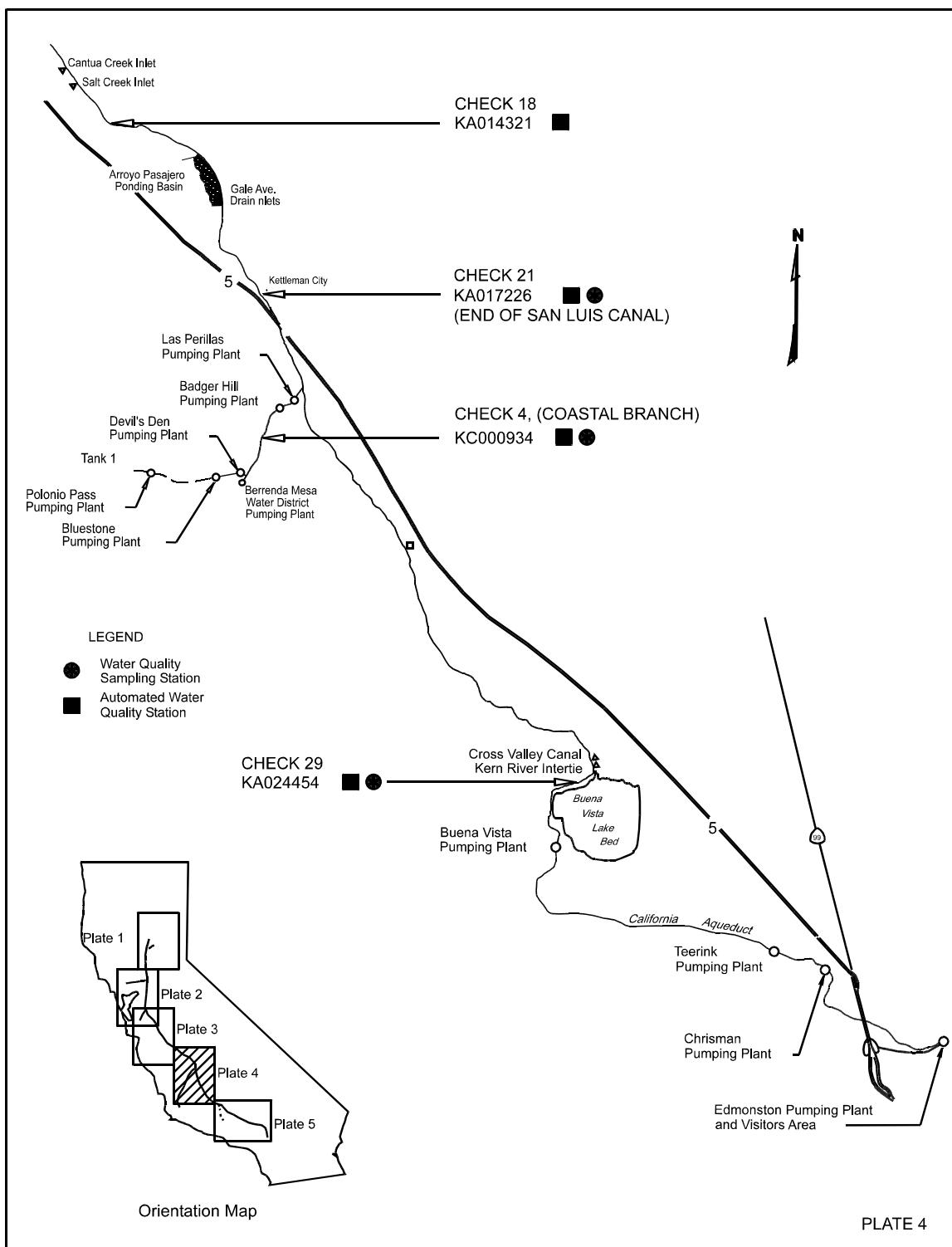


Plate 5

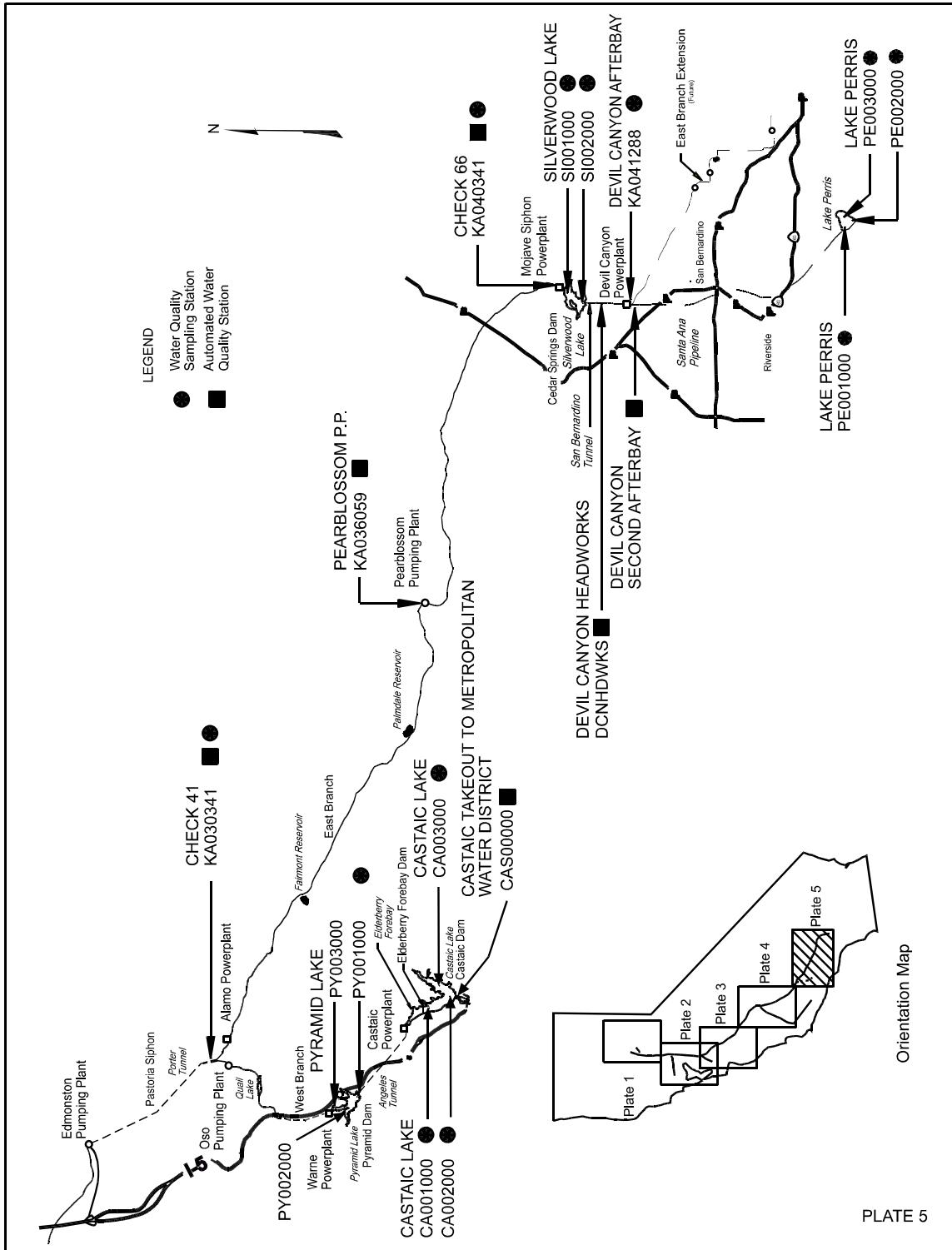


Table A-2
Automated Water Quality Monitoring Stations

Project Area or Facility	Station Name or Description	Parameters Monitored									
		Water Quality			Other						
		Conductivity	Temperature	pH	Fluorometry	Petroleum Hydrocarbons	Water Depth	Tank Depth	Rainfall	Flow	Tide Elevation
North and South Bay Aqueducts	NBA, Barker Sl. Pumping Plant	X	X	X	X	X			X	X	X
	NBA, Cordelia Forebay	X	X	X			X		X		
	SBA, Check 7	X	X	X	X	X					
	SBA, Del Valle Res. Outlet	X	X	X	X	X					X
	SBA, Santa Clara Terminal Tank	X	X	X	X			X			
California Aqueduct and Coastal Branch	Clifton Court Forebay	X	X	X	X						X
	Banks Pumping Plant	X	X	X	X				X		
	Check 12		X	X							
	Check 13		X	X	X	X					
	Check 18		X	X	X						
	Check 21		X	X	X						X
	Coastal Branch		X	X	X						
	Check 29		X	X	X						
	Check 41		X	X	X						
	Pearblossom Pumping Plant			X							
	Check 66			X							
	Devil Canyon Headworks		X	X	X	X					
	Devil Canyon Second Afterbay		X	X	X						
San Luis Reservoir Project Lakes in Southern California	San Luis Res., Pacheco Pumping Plant	X	X	X	X	X					
	Metropolitan Water District Pipeline at Castaic Lake		X	X	X	X					
Central Valley Project 1/ 1/	Delta-Mendota Canal near O'Neill PGP	X	X								

1/ Operated and Maintained by the U.S.BR.

Table A-3
Methods for Water Quality Analysis

Constituent	Method ^a	Reference
MINERAL		
Calcium	AA, flame	EPA 215.1
Magnesium	AA, flame	EPA 242.1
Hardness	Calculated from calcium and magnesium	Std. Met.
Sodium	AA, flame	EPA 273.1
Potassium	AA, flame	EPA 258.1
Alkalinity	Titrimetric	EPA 310.1
pH	Electrometric	EPA 150.1
Sulfate	Colorimetric, Automated MTB	EPA 375.2
Chloride	Colorimetric, Automated	EPA 325.2
Nitrate	Colorimetric, Automated Cd reduction	EPA 353.2
Fluoride	Potentiometric ISE	EPA 340.2
Boron	Colorimetric, Automated, Azomethine	USGS I-2115-85
Turbidity	Nephelometric	EPA 180.1
Dissolved Solids	Gravimetric, 180°C	EPA 160.1
Specific Conductance	Wheatstone Bridge	EPA 120.1
Silica	Colorimetric, Molybdate Blue	USGS I-1700-85
METALS		
Aluminum	AA, direct & furnace, Zeeman	EPA 202.1, 202.2
Arsenic	AA, hydride	EPA 206.3
Barium	AA, direct	EPA 208.1
Cadmium	AA, furnace, Zeeman	EPA 213.2
Chromium	AA, furnace, Zeeman	EPA 218.2
Chromium (+6)	AA, furnace, Zeeman	EPA 218.5
Colbalt	AA, furnace, Zeeman	EPA 219.2
Copper	AA, direct & furnace, Zeeman	EPA 220.1, 220.2
Iron	AA, direct & furnace, Zeeman	EPA 236.1, 236.2
Lead	AA, furnace, Zeeman	EPA 239.2
Lithium	AA, direct	USGS I-1425-85
Manganese	AA, furnace, Zeeman	EPA 243.1, 243.2
Mercury	AA, cold vapor	EPA 245.1
Molybdenum	AA, furnace, Zeeman	EPA 246.2
Nickel	AA, direct & furnace, Zeeman	EPA 249.1, 249.2
Selenium	AA, hydride	EPA 270.3
Silver	AA, Zeeman	EPA 272.2
Strontium	AA, direct	USGS I-1800-85
Zinc	AA, direct & furnace, Zeeman	EPA 289.1, 289.2
Barium	AA, furnace, Zeeman	EPA 208.2
Vanadium	AA, furnace, Zeeman	EPA 286.2

^a Abbreviations:

AA — Atomic Absorption

HPLC — High Performance Liquid Chromatography

GC — Gas Chromatography

Table A-3 (Con't)
Methods for Water Quality Analysis

Constituent	Method ^a	Reference	
NUTRIENTS			
Ammonia	Colorimetric, Automated Phenate	EPA	350.1
Ammonia + Organic N	Colorimetric, Semi-Automated	EPA	351.2
Nitrate	Colorimetric, Auto Cd Reduction	EPA	353.2
Nitrite	Colorimetric, Auto Cd Reduction	EPA	353.2
Nitrate + Nitrite	Colorimetric, Auto Cd Reduction	EPA	353.2
Phosphate	Colorimetric, Ascorbic acid	EPA	365.1
Phosphorus	Colorimetric, Semi-Automated	EPA	365.4
MISCELLANEOUS			
Settleable Solids	Volumetric, Imhoff	EPA	160.5
Suspended Solids	Gravimetric, 105°C	EPA	160.2
Color, True	Colorimetric, Pt-Co	EPA	110.2
Methylene Blue Act Sub.	Colorimetric	EPA	425.1
COD	Titrimetric, low level	EPA	410.2
Tannin & Lignin	Colorimetric	Std. Met.	5550B
Oil & Grease	Gravimetric, extraction	EPA	413.1
Cyanide	Titrimetric, Spectrophotometric	EPA	335.1
Phenols	Spectrophotometric, Distillation	EPA	420.1
BOD	Incubation 20°C	EPA	405.1
Organic Carbon	Wet Oxidation, IR, Auto	EPA	415.1
Volatile Suspended Solids	550°C	EPA	160.4
Bromide	Ion Chromatography	Std. Met	4110B
ORGANICS			
THM Formation Potential	GC	EPA	502.2
Chloroform			
Bromodichloromethane			
Dibromochloromethane			
Bromoform			
Chlorinated Organics	GC	EPA	608
Pesticides	Reporting Limits in µg/l:		
Drinon	0.05		
BHC, alpha	0.01		
Chlopropham	0.02		
Dichloran	0.01		
Simazine	0.02		
BHC, gamma	0.01		

^a **Abbreviations:**

AA — Atomic Absorption

GC — Gas Chromatography

HPLC — High Performance Liquid Chromotography

Table A-3 (Con't)
Methods for Water Quality Analysis

Constituent	Method ^a	Reference
ORGANICS (Continued)		
Chlorinated Organic Pesticides (Cont'd)	GC	EPA 608
BHC, beta	Reporting Limits in µg/l:	0.01
Atrazine		0.02
PCNB		0.01
BHC, delta		0.01
Chlorothalonil		0.01
Alachlor		0.05
Heptachlor		0.01
Thiobencarb		0.02
Chlorpyrifos		0.01
Aldrin		0.01
DCPA		0.01
Captan		0.02
Heptachlor Epoxide		0.01
Chlordane		0.05
Endosulfan I		0.01
Dieldrin		0.01
DDE		0.01
Endrin		0.01
Endosulfan II		0.01
Endrin Aldehyde		0.01
DDD		0.01
Endosulfan Sulfate		0.01
DDT		0.01
Methoxychlor		0.01
Dicofol		0.01
Toxaphene		0.20
PCB-1016		0.10
PCB-1221		0.10
PCB-1232		0.10
PCB-1248		0.10
PCB-1254		0.10
PCB-1260		0.10
Metolachlor		0.20
Oxyfluorfen		0.20

^a Abbreviations:

AA — Atomic Absorption

GC — Gas Chromatography

HPLC — High Performance Liquid Chromotography

Table A-3 (Con't)
Methods for Water Quality Analysis

Constituent	Method ^a	Reference
ORGANICS (Continued)		
Organic Phosphorus Pesticides	GC	EPA 614
Mevinphos	Reporting Limits in µg/l:	0.01
Demeton		0.02
Naled		0.02
Phorate		0.01
Dimethoate		0.01
Diazinon		0.01
Disulfoton		0.01
Methyl Parathion		0.01
Malathion		0.01
Chlorpyrifos		0.01
Parathion		0.01
Methidathion		0.02
Profenofos		0.01
s,s,s-Tributyl Phosphorotrithioate (DEF)		0.01
Ethion		0.01
Carbophenothion (Trithion)		0.02
Phosmet		0.02
Phosalone		0.02
Azinphosmethyl		0.05
Bromacil		1.0
Cyanazine		0.01
Naproazmide		5.0
Norflurazon		5.0
Pendimethalin		5.0
Prometryn		0.1
Propetamphos		0.05
Trifluralin		0.05
Benfluralin		0.05
Chlorinated Phenoxy Acid Herbicides	GC	EPA 615
Dicamba	Reporting Limits in µg/l:	0.1
MCPP		0.1
Pentachlorophenol (PCP)		0.1
Dichlororop		0.1
2,4,-D		0.1
MCPA		0.1
2,4,5 -TP		0.1
2,4,5 -T		0.1
2,4, -DB		0.1
Picloram		0.1
Triclophr		0.1

^a Abbreviations:

AA — Atomic Absorption

GC — Gas Chromatography

HPLC — High Performance Liquid Chromotography

Table A-3 (Con't)
Methods for Water Quality Analysis

Constituent	Method ^a	Reference
ORGANICS (Continued)		
Purgeable Organics	GC	EPA 602
Dichlorodifluoromethane	Reporting Limits in µg/l:	0.5
Chloromethane		0.5
Vinyl chloride		0.5
Bromomethane		0.5
Chloroethane		0.5
Trichlorofluoromethane		0.5
1,1-Dichloroethene		0.5
Methylene chloride		0.5
trans- 1,2-Dichloroethene		0.5
1,1-Dichloroethane		0.5
2,2-Dichloropropane		0.5
cis- 1,2-Dichloroethene		0.5
Chloroform		0.5
Bromochloromethane		0.5
1,1,1- Trichloroethane		0.5
1,1-Dichloropropene		0.5
Carbon tetrachloride		0.5
Benzene		0.5
1,2-Dichloroethane		0.5
Trichloroethene		0.5
1,2-Dichloropropane		0.5
Bromodichloromethane		0.5
Dibromomethane		0.5
cis-1,3-Dichloropropene		0.5
Tolune		0.5
trans-1, 3-Dichloropropene		0.5
1,1,2-Trichloroethane		0.5
1,3-Dichloropropane		0.5
Tetrachloroethene		0.5
Dibromochloromethane		0.5
1,2-Dibromoethane		0.5
Chlorobenzene		0.5
Ethyl benzene		0.5
1,1,1,2-Tetrachloroethane		0.5
m-Xylene		0.5
p-Xylene		0.5
o-Xylene		0.5
Styrene		0.5
Isopropyl benzene		0.5
Bromoform		0.5

^a Abbreviations:

AA — Atomic Absorption

GC — Gas Chromatography

HPLC — High Performance Liquid Chromotography

Table A-3 (Con't)
Methods for Water Quality Analysis

Constituent	Method ^a	Reference	
ORGANICS (Continued)			
Purgeable Organics (cont'd)	GC	EPA	602
1,1,2,2-Tetrachloroethane	Reporting Limits in µg/l:	0.5	
1,2,3-Trichloropropane		0.5	
n-Propyl benzene		0.5	
Bromobenzene		0.5	
1,3,5-Trimethylbenzene		0.5	
2-Chlorotoluene		0.5	
4-Chlorotoluene		0.5	
tert-Butylbenzene		0.5	
1,2,4-Trimethylbenzene		0.5	
sec-Butylbenzene		0.5	
4-Isopropyltoluene		0.5	
1,3-Dichlorobenzene		0.5	
1,4-Dichlorobenzene		0.5	
n-Butylbenzene		0.5	
1,2-Dichlorobenzene		0.5	
1,2-Dibromo-3-chloropropane		0.5	
1,2,4-Trichlorobenzene		0.5	
Hexachlorobutadiene		0.5	
Naphthalene		0.5	
1,2,3- Trichlorobenzene		0.5	
Carbamates	HPLC	EPA	531.1
Aldicarb Sulfoxide	Reporting Limits in µg/l:	2	
Aldicarb Sulfone		2	
Oxamyl		2	
Methomyl		2	
3-Hydroxycarbofuran		2	
Aldicarb		2	
Carbofuran		2	
Carbaryl		2	
1-Naphthol		4	
Methiocarb		4	
Formetanate Hydrochloride		100	
Miscellaneous Pesticides	HPLC	EPA	531.1
Glyphosate	Reporting Limits in µg/l:	100	
Aminomethylphosphonic Acid		100	
Propargite		1	

^a Abbreviations:

AA — Atomic Absorption

GC — Gas Chromatography

HPLC — High Performance Liquid Chromatography

Appendix B

Water Quality Standards and Objectives

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Table B-1
MCLs and Article 19 Objectives for Inorganic Parameters

Parameter	Units	Primary MCL	Secondary MCLs			Article 19 Objectives	
			Recommended	Upper	Short Term	Monthly Average	10 year Average
Asbestos	MFL a/	7					
Conductivity (Specific Conductance)	µS/cm		900	1600	2200		
Chloride	mg/L		250	500	600	110	55
Nitrate as NO ₃	mg/L	45					
Nitrate + Nitrite sum as N	mg/L	10					
Nitrite as N	mg/L	0.4					
Sodium	% b/					50	40
Sulfate	mg/L		250	500	600		
Total Dissolved Solids	mg/L		500	1000	1500	440	220
Total Hardness as CaCO ₃	mg/L					180	110

a/ Million Fibers per Liter: MCL for fibers exceeding 10 µm in length.

b/ Percentage of cationic composition

Table B-2
MCLs and Article 19 Objectives for Minor Elements

Minor Element	Article 19 Objectives mg/L		Secondary MCL
	Maximum	Primary MCL	
Aluminum		1	0.2
Antimony		0.006	
Arsenic	0.05	0.05	
Barium		1	
Beryllium		0.004	
Boron	0.6 b/		
Cadmium		0.005	
Chromium		0.05	
Hexavalent Chromium	0.05		
Copper	3.0		1.0
Cyanide		0.2	
Fluoride	1.5	1.4-2.4 a/	
Iron			0.3
Iron+Manganese	0.3		
Lead	0.1		
Mercury		0.002	
Nickel		0.1	
Selenium	0.05	0.05	
Silver			0.1
Thallium		0.002	
Zinc	15		5.0
a/	Temperature Dependent Degrees C	MCL (mg/L)	b/ Monthly Average
	12.0 and below	2.4	
	12.1 to 14.6	2.2	
	14.7 to 17.6	2.0	
	17.7 to 21.4	1.8	
	21.5 to 26.2	1.6	
	26.3 to 32.5	1.4	

Table B-3
Primary Maximum Contaminant Levels for Organic Chemicals

Volatile Organic Chemicals (VOCs)	MCL mg/L	Non-Volatile Synthetic Organic Chemicals	MCL mg/L
Benzene	0.001	Alachlor	0.002
Carbon Tetrachloride	0.0005	Atrazine	0.003
1,2-Dichlorobenzene	0.6	Bentazon	0.018
1,4-Dichlorobenzene	0.005	Benzo(a)pyrene	0.0002
1,1 -Dichloroethane	0.005	Carbofuran	0.018
1,2-Dichloroethane	0.0005	Chlordane	0.0001
1,1 -Dichloroethylene	0.006	2,4-D	0.07
cis- 1,2-Dichloroethylene	0.006	Dalapon	0.2
trans- 1,2-Dichloroethylene	0.01	Dacthal (DBCP)	0.0002
Dichloromethane	0.005	Di(2-ethylhexyl)adipate	0.4
1,2-Dichloropropane	0.005	Di(2-ethylhexyl)phthalate	0.004
1,3-Dichloropropene	0.0005	Dinoseb	0.007
Ethylbenzene	0.7	Diquat	0.02
Monochlorobenzene	0.07	Endothall	0.1
Styrene	0.1	Endrin	0.002
1,1,2,2-Tetrachloroethane	0.001	Ethylene Dibromide (EDP)	0.00005
Tetrachloroethylene	0.005	Glyphosate	0.7
Toluene	0.15	Heptachlor	0.00001
1,2,4-Trichlorobenzene	0.07	Heptachlor Epoxide	0.00001
1,1,1 -Trichloroethane	0.2	Hexachlorobenzene	0.001
1,1,2-Trichloroethane	0.005	Hexachlorocyclopentadiene	0.05
Trichloroethylene	0.005	Lindane	0.0002
Trichlorofluoromethane	0.15	Methoxychlor	0.04
1,1,2-Trichloro- 1,2,2-Trifluoroethane	1.2	Methyl tertiary-butyl ether (MtBE)	0.005 b/
Vinyl Chloride	0.0005	Molinate	0.02
Xylenes	1.750 a/	Oxamyl	0.2
		Pentachlorophenol	0.001
		Picloram	0.5
		Polychlorinated Biphenyls	0.0005
		simazine	0.004
		Thiobencarb c/	0.07
		Toxaphene	0.003
		2,3,7,8-TCDD (Dioxin)	3 x 10-8
		2,4,5-TP (Silvex)	0.05

a/ MCL is for either a single isomer or the sum of the isomers.

b/ Secondary MCL

c/ Secondary MCL=0.001 mg/L

Appendix C

Data Tables

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Table C-1
Conventional Parameter, Major Mineral, Fluoride, and Boron Concentrations in the SWP

CONCENTRATION (mg/L unless otherwise noted)																
STATION	DATE	HARDNESS (as CaCO ₃)	CALCIUM	MAGNESIUM	SODIUM	POTASSIUM	TOTAL ALKALINITY (as CaCO ₃)	LAB pH (pH units)	SULFATE	CHLORIDE	NITRATE (as NO ₃)	FLUORIDE	BORON	TURBIDITY (NTU)	DISSOLVED SOLIDS	CONDUCTIVITY (μ S/cm)
AN001000	5/22/96 26	7	2	4	1.2	32	6.8	2	< 1	< 0.1	< 0.1	< 0.1	69	66		
AN001000	5/22/97 28	8	2	4	1.6	44	6.7	2	< 1	< 0.1	< 0.1	< 0.1	68	78		
FR001000	5/22/96 42	10	4	5	1.4	48	7.0	2	< 1	< 0.1	< 0.1	< 0.1	79	99		
FR001000	5/22/97 42	10	4	5	1.2	54	6.8	1	< 1	< 0.1	< 0.1	< 0.1	66	100		
LD001000	5/23/96 23	6	2	3	1.1	30	6.7	2	< 1	< 0.1	< 0.1	< 0.1	54	63		
LD001000	5/27/97 23	6	2	3	1.0	34	6.6	^	1	1	< 0.1	< 0.1	46	61		
TA001000	1/17/96 28	6	3	3		33	7.0	2	1	< 0.1	< 0.1	< 0.1	50	75		
TA001000	3/20/96 30	7	3	3		30	6.8	2	1	< 0.1	< 0.1	< 0.1	50	71		
TA001000	4/17/96 30	7	3	3		34	6.7	2	1	< 0.1	< 0.1	< 0.1	56	74		
TA001000	5/15/96 30	7	3	4		36	6.8	2	1	< 0.1	< 0.1	< 0.1	45	78		
TA001000	6/19/96 30	7	3	3		34	6.9	1	< 1	< 0.1	< 0.1	< 0.1	57	72		
TA001000	7/17/96 32	8	3	3		36	6.8	2	2	< 0.1	< 0.1	< 0.1	51	77		
TA001000	8/20/96 30	7	3	2		36	6.7	2	1	< 0.1	< 0.1	< 0.1	2	54	78	
TA001000	9/18/96 30	7	3	3		35	7.1	2	1	< 0.1	< 0.1	< 0.1	2	48	76	
TA001000	10/16/96 30	7	3	3		41	7.1	2	1	< 0.1	< 0.1	< 0.1	4	56	75	
TA001000	11/20/96 30	7	3	3		36	7.0	2	1	< 0.1	< 0.1	< 0.1	3	58	74	
TA001000	12/18/96 32	8	3	3		39	6.9	2	1	< 0.1	< 0.1	< 0.1	2	54	80	
TA001000	1/15/97 23	6	2	2		27	6.7	2	1	0.2	< 0.1	< 0.1	54	40	60	
TA001000	2/19/97 23	6	2	2		30	6.6	2	1	0.2	< 0.1	< 0.1	50	48	62	
TA001000	3/19/97 23	6	2	2		31	6.7	1	1	< 0.1	< 0.1	< 0.1	34	48	63	
TA001000	4/16/97 23	6	2	2		30	6.6	^	2	1	< 0.1	< 0.1	23	40	63	
TA001000	5/21/97 30	7	3	3		33	6.6	^	1	1	< 0.1	< 0.1	12	59	69	
TA001000	6/18/97 30	7	3	3		34	6.6	2	1	< 0.1	< 0.1	< 0.1	14	50	73	
TA001000	7/16/97 32	8	3	3		35	7.8	2	1	< 0.1	< 0.1	< 0.1	8	54	75	
TA001000	8/20/97 32	8	3	3		37	7.7	2	1	< 0.1	< 0.1	< 0.1	55	77		
TA001000	9/17/97 32	8	3	3		36	7.7	2	1	< 0.1	< 0.1	< 0.1	52	75		
TA001000	10/15/97 32	8	3	3		35	7.7	1	1	< 0.1	< 0.1	< 0.1	12	48	74	
TA001000	11/19/97 32	8	3	3		37	7.8	2	1	< 0.1	< 0.1	< 0.1	8	49	80	
TA001000	12/17/97 32	8	3	3		38	7.7	2	1	< 0.1	< 0.1	< 0.1	7	49	81	
TF001000	5/15/96 30	7	3	3		35	6.8	2	1	< 0.1	< 0.1	< 0.1	48	77		
TF001000	8/20/96 30	7	3	2		36	6.7	2	2	< 0.1	< 0.1	< 0.1	< 1	41	77	
TF001000	11/20/96 30	7	3	3		36	7.0	2	1	0.2	< 0.1	< 0.1	< 1	61	75	
TF001000	2/19/97 23	6	2	2		29	6.7	2	1	0.1	< 0.1	< 0.1	50	55	62	
TF001000	5/21/97 30	7	3	3		34	6.6	^	1	1	< 0.1	< 0.1	54	69		
TF001000	8/20/97 32	8	3	3		36	7.6	2	1	0.1	< 0.1	< 0.1	54	74		
TF001000	11/19/97 32	8	3	4		40	7.6	2	1	0.2	< 0.1	< 0.1	5	53	84	
KG000000	1/17/96 46	7	7	16		41	7.2	12	10	16.0	0.1	0.1	109	181		
KG000000	2/21/96 56	9	8	18		65	7.2	8	8	5.4	0.1	0.2	126	187		
KG000000	3/20/96 56	9	8	22		63	7.2	12	15	0.6	^	0.2	134	210		
KG000000	4/17/96 130	19	20	35		122	7.5	40	27	1.8	0.1	0.3	236	406		
KG000000	5/15/96 152	23	23	36		141	8.0	45	28	1.8	0.2	0.4	258	445		
KG000000	6/19/96 102	16	15	25		101	7.8	27	18	1.9	0.1	0.2	33	181	311	
KG000000	7/17/96 95	15	14	22		93	7.3	21	17	1.7	0.1	0.2	167	280		
KG000000	8/21/96 82	13	12	17		90	7.4	16	13	1.0	0.1	0.1	30	148	257	
KG000000	9/18/96 91	15	13	20		98	7.7	19	16	0.8	0.1	0.1	29	150	285	
KG000000	10/2/96					105	7.5						25			
KG000000	10/9/96					95	7.7						25			
KG000000	10/16/96 94	16	13	23		111	8.3	20	18	0.9	0.1	0.2	30	172	307	
KG000000	10/23/96					102	7.9						25			
KG000000	10/30/96					106	7.9						22			
KG000000	11/5/96					108	7.5						22			
KG000000	11/13/96					100	7.4						27			
KG000000	11/20/96 109	17	16	30		114	7.7	24	28	1.0	< 0.1	0.2	19	191	356	
KG000000	11/25/96					110	7.4						21			
KG000000	12/4/96					121	7.5						26			
KG000000	12/9/96					119	7.6						21			
KG000000	12/18/96 119	18	18	41		110	7.4	40	39	2.2	0.1	0.3	35	250	424	
KG000000	12/23/96					37	6.3						160			
KG000000	12/30/96					51	7.0						218			
KG000000	1/7/97					48	6.8						102			
KG000000	1/15/97 52	9	7	18		68	7.2	9	10	0.7	0.1	0.2	68	116	186	
KG000000	1/22/97					78	7.0						56			
KG000000	1/29/97					49	6.8						165	126		
KG000000	2/5/97					58	6.8						88			
KG000000	2/10/97					72	6.9						54			
KG000000	2/19/97 78	13	11	29		88	7.1	21	26	0.5	< 0.1	0.2	52	175	294	
KG000000	2/26/97					88	7.2						58			
KG000000	3/5/97					87	7.1						68			
KG000000	3/12/97					90	7.0						64			
KG000000	3/19/97 95	15	14	32		102	7.4	30	26	1.7	0.1	0.2	56	205	345	
KG000000	3/26/97					114	7.4						32			
KG000000	4/2/97					4.5							42			
KG000000	4/8/97					139	7.7						22			
KG000000	4/16/97 151	24	22	44		152	7.8	53	37	1.6	0.2	0.4	29	277	495	
KG000000	4/23/97					149	7.9						27			
KG000000	4/28/97					152	7.8						29			
KG000000	5/7/97					138	7.6						37			
KG000000	5/14/97					129	7.6						44			
KG000000	5/21/97 120	20	17	28		120	7.4	30	23	2.1	0.1	0.2	46	211	358	
KG000000	5/27/97					138	7.3						56			
KG000000	6/4/97					127	7.0						54			
KG000000	6/11/97					115	7.3						68			
KG000000	6/18/97 94	16	13	24		101	7.2	24	19	3.0	0.1	0.2	68	178	306	

Table C-1 (Con't)
Conventional Parameter, Major Mineral, Fluoride, and Boron Concentrations in the SWP

CONCENTRATION (mg/L unless otherwise noted)																
STATION	DATE	HARDNESS (as CaCO ₃)	CALCIUM	MAGNESIUM	SODIUM	POTASSIUM	TOTAL ALKALINITY (as CaCO ₃)	LAB pH (pH units)	SULFATE	CHLORIDE	NITRATE (as NO ₃)	FLUORIDE	BORON	TURBIDITY (NTU)	DISSOLVED SOLIDS	CONDUCTIVITY (µS/cm)
KG000000	6/25/97						109	7.0							56	
KG000000	7/2/97						96	7.1						76		
KG000000	7/16/97	87	15	12	21		87	8.1	16	16	1.4	0.1	0.2	68	154	249
KG000000	8/20/97	90	16	12	18		89	7.8	12	12	0.6	0.1	0.1	52	142	242
KG000000	9/17/97	118	19	17	21		121	8.1	18	14	0.8	0.1	0.2	44	180	313
KG000000	10/15/97	96	17	13	24		101	8.1	17	18	1.2	0.1	0.2	45	167	291
KG000000	11/19/97	126	19	19	24		114	8.0	28	21	2.8	0.1	0.2	51	207	350
KG000000	12/17/97	99	15	15	34		104	7.8	27	33	1.3	0.1	0.2	114	214	372
KG002111	2/21/96	84	14	12	28		91	7.4	19	19	1.7	0.1	0.2		185	286
KG002111	5/15/96	152	23	23	38		144	8.0	46	29	1.9	0.2	0.4		259	456
KG002111	8/21/96	84	14	12	16		93	7.3	15	11	1.1	< 0.1	0.1	29	153	257
KG002111	11/20/96	107	18	15	26		111	7.6	24	23	1.4	< 0.1	0.2	72	184	336
KG002111	2/19/97	78	13	11	28		88	7.1	24	19	1.0	0.1	0.2	54	179	282
KG002111	5/21/97	120	20	17	29		120	7.4	25	24	2.2	0.1	0.2	58	214	365
KG002111	8/20/97	90	16	12	17		87	8.0	12	11	0.9	0.1	0.1	48	142	237
KG002111	11/19/97	109	17	16	27		109	8.0	26	24	1.6	0.1	0.2	32	192	343
DV000000	10/16/96	152	31	18	15		153	8.5	35	10	0.3	< 0.1	0.1	2	220	385
DV000000	2/19/97	128	28	14	10		118	7.8	24	6	1.8	< 0.1	0.1	28	169	285
DV000000	6/18/97	143	29	17	14		144	7.8	32	9	0.6	0.1	0.1	3	202	358
DV000000	9/17/97	162	32	20	18		142	8.4	36	12	< 0.1	0.1	0.2	1	211	373
DV000000	10/15/97	149	30	18	18		140	8.3	33	12	0.3	0.1	0.1	2	206	370
DV001000	9/18/96	177	36	21	14		153	8.1	35	9	< 0.1	0.1	0.1	< 1	215	394
DV001000	11/20/96	172	34	21	16		157	8.1	38	11	0.2	0.1	0.2	3	233	404
DV001000	12/18/96	170	35	20	16		152	8.0	38	10	1.3	0.1	0.2	27	227	386
DV001000	1/15/97	139	29	16	13		127	8.0	29	8	2.2	0.1	0.1	38	182	323
KB001638	4/16/97	82	18	9	30		68	7.3	36	34	3.2	< 0.1	0.2	6	174	323
KB001638	5/21/97	98	21	11	45		72	7.1	55	53	2.5	< 0.1	0.2	8	289	500
KB001638	6/18/97	84	17	10	35		66	6.9	37	39	3.6	< 0.1	0.2	9	197	350
KB001638	7/16/97	68	14	8	28		57	8.0	17	33	0.9	< 0.1	0.1	10	145	254
KB001638	8/20/97	66	13	8	28		58	8.0	16	33	0.4	< 0.1	0.1	7	149	265
KB001638	9/17/97	77	16	9	27		74	8.6	18	30	0.3	< 0.1	0.1	5	148	278
KB001638	10/15/97	96	17	13	61		71	8.0	25	86	1.2	< 0.1	0.1	2	259	489
KB001638	11/19/97	84	16	12	66		65	8.1	32	95	3.0	< 0.1	0.1	4	285	513
KB001638	12/17/97	120	20	17	85		69	7.9	37	131	3.8	< 0.1	0.1	10	349	657
KB004207	2/21/96	149	30	18	16		128	8.0	33	13	1.4	< 0.1	0.2	212	352	
KB004207	3/20/96	136	28	16	12		117	8.2	26	8	0.8	< 0.1	0.1		185	310
KB004207	5/15/96	84	17	10	39		58	8.2	50	46	2.5	< 0.1	0.2		201	370
KB004207	8/21/96	56	11	7	22		55	7.6	14	28	0.8	< 0.1	0.1		8	130
KB004207	9/18/96	136	28	16	18		122	8.3	28	15	0.3	< 0.1	0.1		1	177
KB004207	10/16/96	134	27	16	21		130	8.5	31	18	0.7	< 0.1	0.1		2	202
KB004207	11/20/96	178	35	22	16		161	8.2	38	11	0.1	0.1	0.2		224	405
KB004207	12/18/96	102	21	12	29		89	7.6	29	38	3.9	< 0.1	0.1		15	198
KB004207	1/15/97	80	17	9	21		71	7.5	24	21	4.1	< 0.1	0.2		15	150
KB004207	2/19/97	78	18	8	20		74	7.6	25	19	2.7	< 0.1	0.2		19	162
KB004207	5/21/97	102	21	12	45		72	7.1	57	53	3.1	< 0.1	0.2		2	252
KB004207	8/20/97	68	14	8	27		58	8.0	16	33	0.6	< 0.1	0.1		6	149
KB004207	9/17/97	118	24	14	23		108	8.3	27	21	0.6	< 0.1	0.1		6	187
KB004207	10/15/97	134	27	16	34		113	8.3	30	42	0.6	< 0.1	0.1		2	226
KB004207	11/19/97	90	16	12	66		64	8.0	31	96	3.0	< 0.1	0.1		4	278
KA000000	2/21/96	70	15	8	31	1.6	42	7.0	45	31	3.9	0.2			180	299
KA000000	5/15/96	100	20	12	46	2.0	60	7.2	59	56	3.6	0.3			234	432
KA000000	8/21/96	56	11	7	21		53	6.9	13	27	1.1				5	131
KA000000	11/20/96	92	19	11	46	2.7	71	7.5	35	65	4.1				6	241
KA000000	1/7/97	39	9	4	10	2.4	48	6.8	10	9	2.1	< 0.1				87
KA000000	2/19/97	50	12	5	17	1.9	42	6.9	22	18	1.8	< 0.1	0.1		19	128
KA000000	5/21/97	119	26	13	53	3.0	79	7.0	67	63	5.3	< 0.1	0.3		10	254
KA000000	8/20/97	74	15	9	29	2.2	60	7.9	17	34	1.1				9	159
KA000000	11/19/97	84	14	12	59	3.3	60	7.9	24	90	2.2				7	261
KA000331	1/17/96	86	18	10	21		65	7.6	26	26	3.5	< 0.1	0.1			165
KA000331	2/21/96	95	20	11	38		55	7.3	52	43	5.3	< 0.1	0.2			229
KA000331	3/20/96	68	14	8	26		48	7.2	36	30	2.3	< 0.1	0.2			174
KA000331	4/17/96	86	18	10	40		59	7.0	50	48	2.4	< 0.1	0.3			219
KA000331	5/15/96	84	17	10	39		50	7.1	51	47	3.5	< 0.1	0.2			206
KA000331	6/19/96	64	14	7	22		50	7.1	25	24	2.3	< 0.1	0.1			141
KA000331	7/17/96	56	11	7	14		51	7.1	12	15	1.1	< 0.1	0.1			109
KA000331	8/21/96	56	11	7	21		53	7.1	14	28	1.0	< 0.1	0.1			135
KA000331	9/18/96	66	13	8	21		67	7.7	16	25	1.2	< 0.1	0.1			132
KA000331	10/16/96	78	15	10	35		79	7.7	22	41	2.1	< 0.1	0.1			324
KA000331	11/20/96	85	16	11	46		66	7.4	27	67	2.7	< 0.1	0.1			216
KA000331	12/18/96	68	14	8	33		56	7.2	24	45	2.7	< 0.1	0.1			414
KA000331	1/15/97	48	11	5	17		41	7.0	17	18	3.4	< 0.1	0.1			8
KA000331	2/19/97	60	14	6	20		45	7.0	25	20	2.4	< 0.1	0.2			129
KA000331	3/19/97	84	19	9	34		58	7.0	44	39	3.4	< 0.1	0.2			204
KA000331	4/16/97	82	18	9	30		68	7.2	35	34	3.3	< 0.1	0.2			161
KA000331	5/21/97	102	21	12	46		70	7.1	55	54	3.0	< 0.1	0.3			279
KA000331	6/18/97	77	16	9	30		64	6.9	33	33	3.0	< 0.1	0.1			433
KA000331	7/16/97	68	14	8	27		56	8.0	17	33	1.3	< 0.1	0.1			150
KA000331	8/20/97	70	13	9	28		57	8.0	16	33	0.4	< 0.1	0.1			264
KA000331	9/17/97	81	16	10	28		73</									

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CONCENTRATION (mg/L unless otherwise noted)																
STATION	DATE	HARDNESS (as CaCO ₃)	CALCIUM	MAGNESIUM	SODIUM	POTASSIUM	TOTAL ALKALINITY (as CaCO ₃)	LAB pH (pH units)	SULFATE	CHLORIDE	NITRATE (as NO ₃)	FLUORIDE	BORON	TURBIDITY (NTU)	DISSOLVED SOLIDS	CONDUCTIVITY (μ S/cm)
KA006633	5/14/96 90	18	11	42	2.0	59	7.4	54	49	1.8	0.0	< 0.3	216	395		
KA006633	8/20/96 56	11	7	21	1.6	54	7.3	24	29	0.7	0.0	< 0.1	133	239		
KA006633	11/20/96 78	15	10	43	2.6	65	7.5	24	65	2.7	0.0	< 0.1	214	398		
KA006633	2/19/97 53	13	5	18	2.8	45	7.0	25	20	4.5	0.0	0.2	138	222		
KA006633	5/21/97 107	23	12	46	2.6	78	7.4	57	54	3.6	0.0	0.2	252	444		
KA006633	8/20/97 66	13	8	28	2.3	56	8.0	15	31	0.2	0.0	0.1	140	254		
KA006633	11/19/97 98	18	13	62	3.6	63	8.0	30	95	2.5	0.0	0.1	288	514		
KA007089	1/17/96 110	24	12	44		78	7.8	51	53	5.3	< 0.1	0.2	259	449		
KA007089	2/21/96 95	20	11	38		56	7.1	51	43	5.3	< 0.1	0.3	225	376		
KA007089	3/20/96 84	17	10	35		54	7.4	44	38	3.1	< 0.1	0.3	200	342		
KA007089	4/17/96 100	20	12	45		68	7.4	51	57	3.2	< 0.1	0.2	244	434		
KA007089	5/14/96 106	21	13	50		74	7.5	47	66	3.3	< 0.1	0.2	256	464		
KA007089	6/19/96 77	16	9	32		57	7.1	29	38	2.8	< 0.1	0.1	187	313		
KA007089	7/17/96 97	19	12	41		71	7.5	34	54	2.7	< 0.1	0.2	223	401		
KA007089	8/20/96 81	16	10	35		67	7.7	28	49	1.9	< 0.1	0.1	4	210	358	
KA007089	9/18/96 77	16	9	25		70	7.8	22	31	1.4	< 0.1	< 0.1	4	156	287	
KA007089	10/16/96 74	15	9	30		74	7.8	22	37	2.1	< 0.1	< 0.1	6	174	321	
KA007089	11/20/96 81	16	10	42		67	7.6	27	56	3.0	< 0.1	0.1	4	209	389	
KA007089	12/18/96 68	14	8	34		58	7.2	26	47	3.8	< 0.1	0.1	10	198	330	
KA007089	1/15/97 54	12	6	22		44	7.0	21	25	3.7	< 0.1	0.1	17	126	228	
KA007089	2/19/97 60	14	6	21		49	7.0	25	22	3.7	< 0.1	0.2	11	148	233	
KA007089	3/19/97 80	19	8	33		58	7.1	44	37	3.4	< 0.1	0.2	6	198	340	
KA007089	4/16/97 91	20	10	40		74	7.3	44	47	3.7	< 0.1	0.2	7	203	390	
KA007089	5/21/97 92	19	11	42		75	7.2	33	56	2.8	< 0.1	0.1	2	230	405	
KA007089	6/18/97 86	18	10	38		71	7.1	36	47	3.3	< 0.1	0.2	12	211	375	
KA007089	7/16/97 88	19	10	43		69	8.3	30	53	2.1	< 0.1	0.1	5	218	366	
KA007089	8/19/97 92	19	11	41		67	8.2	25	45	0.8	< 0.1	0.1	5	197	343	
KA007089	9/17/97 84	17	10	29		74	8.1	20	29	1.7	< 0.1	0.1	5	158	287	
KA007089	10/15/97 97	19	12	55		73	8.1	31	74	3.0	< 0.1	0.2	10	251	466	
KA007089	11/19/97 110	21	14	65		70	8.0	38	93	3.5	< 0.1	0.1	9	295	534	
KA007089	12/17/97 125	22	17	86		76	7.9	46	128	4.5	< 0.1	0.2	16	293	682	
KA014323	1/6/97 62	13	7	25	2.4	50	7.2	24	30	3.8	< 0.1	0.1	160	256		
KA017226	1/17/96 116	25	13	47		76	7.7	56	57	6.2	< 0.1	0.2	272	474		
KA017226	2/21/96 102	21	12	37		65	7.2	46	44	6.3	< 0.1	0.3	233	386		
KA017226	3/20/96 86	18	10	34		56	7.4	43	39	3.8	< 0.1	0.2	204	347		
KA017226	4/17/96 86	18	10	39		59	7.2	52	45	2.9	< 0.1	0.3	219	380		
KA017226	5/14/96 110	21	14	52		77	7.5	46	70	3.5	< 0.1	0.2	265	478		
KA017226	6/19/96 86	18	10	37		61	7.3	32	46	3.0	< 0.1	0.1	218	351		
KA017226	7/17/96 74	15	9	29		63	7.5	24	37	1.9	< 0.1	0.1	179	305		
KA017226	8/21/96 81	16	10	37		66	7.6	30	50	1.9	< 0.1	0.1	6	206	368	
KA017226	9/18/96 92	19	11	38		75	7.8	32	51	2.1	< 0.1	0.1	8	199	390	
KA017226	10/16/96 72	14	9	27		76	7.8	19	32	1.5	< 0.1	0.1	7	162	290	
KA017226	11/20/96 81	16	10	38		66	7.7	24	52	2.8	< 0.1	0.1	3	190	358	
KA017226	12/17/96 97	19	12	58		76	7.7	36	76	4.2	< 0.1	0.2	3	279	522	
KA017226	1/14/97 81	16	10	30		61	7.3	44	28	3.8	< 0.1	0.1	22	175	315	
KA017226	2/19/97 71	15	8	27		56	7.1	43	24	3.7	< 0.1	0.2	9	180	287	
KA017226	3/19/97 69	16	7	26		48	6.9	34	29	2.5	< 0.1	0.1	19	169	276	
KA017226	4/16/97 105	22	12	45		75	7.4	52	53	4.7	< 0.1	0.2	10	236	430	
KA017226	5/21/97 92	19	11	42		76	7.3	34	56	2.6	< 0.1	0.2	13	239	403	
KA017226	6/18/97 90	18	11	42		76	7.1	34	55	2.9	< 0.1	0.2	16	226	400	
KA017226	7/15/97 84	17	10	37		64	8.2	26	46	2.0	< 0.1	0.1	11	194	327	
KA017226	8/20/97 102	21	12	45		72	8.4	31	55	0.9	< 0.1	0.2	8	221	394	
KA017226	9/17/97 77	16	9	26		71	8.2	20	27	1.5	< 0.1	0.1	13	148	273	
KA017226	10/15/97 92	19	11	42		78	8.2	26	54	2.2	< 0.1	0.1	9	215	389	
KA017226	11/19/97 108	20	14	74		68	8.1	37	117	3.1	< 0.1	0.1	5	313	602	
KA017226	12/17/97 112	20	15	76		73	8.0	36	112	3.7	< 0.1	0.2	9	322	606	
KA020794	1/9/97 62	13	7	28	3.2	52	7.2	23	35	4.3	< 0.1	0.1	169	291		
KA021031	1/13/97 64	14	7	28		56	7.0	22	34	4.3	< 0.1	0.1	8	157	275	
KA021031	1/28/97 64	14	7	28		54	7.2	23	33	3.5	< 0.1	0.1	5	160	303	
KA021031	2/11/97 64	14	7	27		51	7.1	25	33	3.5	< 0.1	0.1	6	153	276	
KA024454	1/16/96 119	26	13	54		81	7.8	58	63	6.3	< 0.1	0.3	284	504		
KA024454	2/20/96 105	22	12	40		70	7.4	49	45	6.7	< 0.1	0.3	251	406		
KA024454	3/19/96 95	20	11	40		58	7.6	52	47	5.0	< 0.1	0.3	236	397		
KA024454	4/16/96 80	17	9	38		58	7.2	50	42	3.2	< 0.1	0.2	211	361		
KA024454	5/14/96 110	21	14	51		79	7.7	45	70	3.5	< 0.1	0.2	265	479		
KA024454	6/18/96 106	21	13	50		74	7.4	41	66	3.9	< 0.1	0.2	260	464		
KA024454	7/16/96 90	18	11	38		68	7.5	32	50	2.7	< 0.1	0.2	214	377		
KA024454	8/20/96 72	14	9	37		69	7.6	30	51	2.1	< 0.1	0.1	14	197	377	
KA024454	9/17/96 70	15	8	25		67	7.9	20	32	1.3	< 0.1	0.1	39	146	283	
KA024454	10/15/96 72	14	9	24		74	7.8	18	27	1.5	< 0.1	0.1	28	152	269	
KA024454	11/19/96 77	16	9	35		70	7.7	24	48	1.5	< 0.1	0.1	22	195	344	
KA024454	12/17/96 100	20	12	54		78	7.6	39	69	3.4	< 0.1	0.2	26	266	490	
KA024454	1/14/97 28	8	2	7		32	6.8	5	4	1.2	< 0.1	< 0.1	19	66	89	
KA024454	2/18/97 38	12	2	8		46	7.0	6	3	1.0	< 0.1	< 0.1	10	88	118	
KA024454	3/18/97 60	14	6	23		47	7.0	29	26	2.1	< 0.1	0.1	18	147	247	
KA024454	4/15/97 100	22	11	41		72	7.3	50	49	4.8	< 0.1	0.2	18	225	409	
KA024454	5/20/97 92	19	11	42		76	7.2	31	56	3.0	< 0.1	0.2	14	227	401	
KA024454	6/17/97 90	18	11	43		74	7.1	34	55	3.0	< 0.1	0.2	35	219	407	
KA024454	7/15/97 86	18	10	40												

Table C-1 (Con't)
Conventional Parameter, Major Mineral, Fluoride, and Boron Concentrations in the SWP

CONCENTRATION (mg/L unless otherwise noted)																
STATION	DATE	HARDNESS (as CaCO ₃)	CALCIUM	MAGNESIUM	SODIUM	POTASSIUM	TOTAL ALKALINITY (as CaCO ₃)	LAB pH (pH units)	SULFATE	CHLORIDE	NITRATE (as NO ₃)	FLUORIDE	BORON	TURBIDITY (NTU)	DISSOLVED SOLIDS	CONDUCTIVITY (μ S/cm)
KA024454	12/16/97	108	20	14	66	72	8.0	38	98	3.7	< 0.1	0.2	6	293	544	
KA030341	2/21/96	114	24	13	46	3.7	75	7.8	56	52	7.0	< 0.1	0.3	258	454	
KA030341	3/20/96	95	21	10	40	2.8	58	8.0	56	46	4.8	< 0.1	0.3	225	392	
KA030341	4/17/96	79	17	9	36	2.0	52	7.9	47	41	2.9	< 0.1	0.2	209	347	
KA030341	5/15/96	107	21	13	49	3.7	75	8.1	44	70	1.8	< 0.1	0.2	292	470	
KA030341	6/19/96	95	19	11	42	3.2	67	8.1	38	57	3.4	< 0.1	0.2	228	403	
KA030341	7/17/96	90	18	11	37	69	7.5	32	49	2.7	< 0.1	0.2	211	374		
KA030341	8/21/96	90	18	11	38	3.0	68	8.1	31	52	2.4	< 0.1	0.1	28	221	371
KA030341	9/18/96	73	16	8	27	67	7.9	22	35	1.5	< 0.1	< 0.1	28	154	299	
KA030341	10/16/96	68	14	8	24	75	8.0	19	26	1.4	< 0.1	< 0.1	9	149	270	
KA030341	11/20/96	81	16	10	34	76	8.1	25	45	1.7	< 0.1	0.1	7	192	341	
KA030341	12/18/96	84	17	10	40	2.8	72	7.5	29	58	2.7	< 0.1	0.1	6	215	392
KA030341	1/13/97	81	16	10	44	2.8	60	7.2	29	62	4.3	< 0.1	< 0.1	217	408	
KA030341	2/19/97	33	10	2	8	43	7.0	5	3	1.3	< 0.1	< 0.1	6	80	107	
KA030341	3/19/97	64	14	7	25	51	6.9	28	30	2.1	< 0.1	0.1	31	152	263	
KA030341	4/16/97	100	22	11	42	74	7.2	53	52	5.0	< 0.1	0.2	48	240	430	
KA030341	5/21/97	92	19	11	43	75	7.3	35	56	2.9	< 0.1	0.2	21	244	404	
KA030341	6/18/97	90	18	11	43	76	7.3	37	54	3.0	< 0.1	0.2	30	227	404	
KA030341	7/16/97	80	17	9	35	64	8.1	24	41	2.4	< 0.1	0.1	28	179	310	
KA030341	8/20/97	100	20	12	46	74	8.6	32	55	0.6	< 0.1	0.2	24	218	400	
KA030341	9/17/97	80	17	9	30	69	8.1	23	33	2.1	< 0.1	0.1	30	159	300	
KA030341	10/15/97	90	18	11	34	76	8.3	22	39	1.2	< 0.1	0.1	21	184	328	
KA030341	11/19/97	108	20	14	74	71	8.1	40	107	3.3	< 0.1	0.2	10	332	588	
KA030341	12/17/97	101	19	13	66	68	8.0	33	96	3.3	< 0.1	0.1	17	277	532	
KA040341	2/21/96	106	23	12	40	2.8	75	8.4	46	47	3.9	< 0.1	0.2	236	404	
KA040341	5/15/96	107	21	13	49	3.7	76	8.2	43	69	1.6	< 0.1	0.2	285	470	
KA040341	8/21/96	84	17	10	33	2.7	65	8.3	28	45	2.0	< 0.1	0.1	24	200	335
KA040341	11/20/96	86	18	10	28	83	8.0	23	32	1.3	< 0.1	0.1	177	309		
KA040341	2/19/97	85					8.5	27	56	0.8	< 0.1	0.1	207	384		
KA040341	5/21/97	92	19	11	43	77	7.4	35	56	2.8	< 0.1	0.2	30	248	404	
KA040341	8/20/97	84	17	10	35	65	8.1	22	42	1.0	< 0.1	0.1	170	320		
KA040341	11/19/97	94	18	12	61	71	8.3	32	86	1.9	< 0.1	0.1	3	274	503	
KA041288	2/21/96	64	15	6	23	2.4	50	7.7	23	26	4.0	< 0.1	0.1	137	245	
KA041288	3/20/96	93	21	10	36	2.7	71	8.0	39	43	3.1	< 0.1	0.2	216	362	
KA041288	4/17/96	85	18	10	34	2.7	62	8.0	38	41	2.9	< 0.1	0.2	203	345	
KA041288	5/15/96	94	19	11	44	2.9	66	8.4	46	56	1.1	< 0.1	0.2	238	416	
KA041288	6/19/96	90	19	11	40	3.0	62	7.9	42	51	2.9	< 0.1	0.2	225	385	
KA041288	7/17/96	90	18	11	39	68	7.6	36	50	2.9	< 0.1	0.2	213	388		
KA041288	8/21/96	89	18	10	35	2.9	67	8.0	31	48	2.4	< 0.1	0.1	8	222	0
KA041288	9/18/96	77	16	9	33	84	8.6	25	43	1.7	< 0.1	0.1	5	174	338	
KA041288	10/16/96	112	17	9	32	73	7.9	25	38	1.8	< 0.1	< 0.1	224	315		
KA041288	11/20/96	80	17	9	30	74	7.6	26	37	1.9	< 0.1	0.1	4	183	319	
KA041288	12/18/96	82	18	9	28	79	7.5	24	36	2.1	< 0.1	0.1	9	178	321	
KA041288	1/13/97	83	20	8	25	2.4	78	7.3	22	28	3.1	< 0.1	< 0.1	167	300	
KA041288	2/19/97	76	24	4	13	98	7.8	9	4	0.9	0.3	< 0.1	127	210		
KA041288	3/19/97	74	18	7	24	74	7.7	20	28	1.5	< 0.1	< 0.1	4	158	271	
KA041288	4/16/97	84	19	9	35	75	7.1	41	40	3.1	< 0.1	0.2	9	199	353	
KA041288	5/21/97	91	20	10	42	77	7.1	38	52	2.5	< 0.1	0.2	7	240	399	
KA041288	6/18/97	95	20	11	45	79	7.2	39	54	2.4	< 0.1	0.2	5	232	426	
KA041288	7/16/97	95	20	11	44	70	8.2	33	51	2.7	< 0.1	0.2	215	375		
KA041288	8/20/97	88	19	10	38	68	8.1	27	45	1.6	< 0.1	0.1	5	193	351	
KA041288	9/17/97	88	19	10	38	71	8.1	28	48	1.1	< 0.1	0.2	3	195	362	
KA041288	10/15/97	86	18	10	33	71	8.1	24	39	1.9	< 0.1	0.1	2	174	328	
KA041288	11/19/97	84	17	10	37	74	8.1	16	45	1.9	< 0.1	0.1	2	200	354	
KA041288	12/17/97	90	18	11	42	74	8.0	27	54	1.9	< 0.1	0.1	1	209	387	
KC000934	2/20/96	95	20	11	36	66	7.5	45	42	5.7	< 0.1	0.2	228	377		
KC000934	5/14/96	110	21	14	52	82	8.0	46	70	3.3	< 0.1	0.2	260	477		
KC000934	6/18/96	90	18	11	39	69	7.9	34	51	2.7	< 0.1	0.2	208	376		
KC000934	7/16/96	90	18	11	37	70	7.9	31	48	2.1	< 0.1	0.2	202	369		
KC000934	8/20/96	84	17	10	38	71	8.3	31	52	1.8	< 0.1	< 0.1	30	210	382	
KC000934	9/17/96	70	15	8	25	69	7.9	20	32	1.1	< 0.1	< 0.1	8	151	281	
KC000934	10/15/96	74	15	9	27	76	7.8	20	31	1.4	< 0.1	0.1	12	163	291	
KC000934	11/19/96	81	16	10	36	80	9.3	26	49	0.2	< 0.1	0.1	6	191	349	
KC000934	12/17/96	86	18	10	44	78	8.2	32	64	1.9	< 0.1	0.2	10	234	418	
KC000934	1/14/97	97	19	12	59	82	9.1	43	78	0.7	< 0.1	0.2	1	272	495	
KC000934	2/18/97	92	19	11	58	84	9.0	42	77	< 1	< 0.1	0.2	10	138	486	
KC000934	3/18/97	66	15	7	26	50	7.1	33	29	2.4	< 0.1	0.1	36	163	271	
KC000934	4/15/97	95	20	11	43	78	7.7	42	55	3.2	< 0.1	0.2	12	229	438	
KC000934	5/20/97	92	19	11	42	75	7.3	34	55	2.6	< 0.1	0.2	13	224	404	
KC000934	6/17/97	92	19	11	42	84	8.3	40	53	2.7	< 0.1	0.2	30	219	402	
KC000934	7/15/97	88	19	10	43	68	8.6	30	53	1.7	< 0.1	0.1	18	217	372	
KC000934	8/19/97	98	21	11	45	72	8.9	32	54	0.4	< 0.1	0.2	6	227	399	
KC000934	9/16/97	77	16	9	26	70	8.4	21	29	1.0	< 0.1	0.1	4	152	278	
KC000934	10/14/97	90	18	11	39	77	8.4	25	49	1.1	< 0.1	0.1	8	200	367	
KC000934	11/18/97	108	20	14	78	72	8.6	41	116	2.0	< 0.1	0.2	3	342	614	
KC000934	12/15/97	108	20	14	67	72	8.3	38	95	3.3	< 0.1	0.2	3	287	547	
SL005000	1/16/96	106	21	13	56	76	7.7	42	78	3.8	< 0.1	0.2	278	501		
SL005000	2/20/96	110	21	14	53	76	7.5	42	72	4.0	< 0.1	0.2	276	482		
SL005000	3/18/96	113</														

Table C-1 (Con't)
Conventional Parameter, Major Mineral, Fluoride, and Boron Concentrations in the SWP

CONCENTRATION (mg/L unless otherwise noted)																
STATION	DATE	HARDNESS (as CaCO ₃)	CALCIUM	MAGNESIUM	SODIUM	POTASSIUM	TOTAL ALKALINITY (as CaCO ₃)	LAB pH (pH units)	SULFATE	CHLORIDE	NITRATE (as NO ₃)	FLUORIDE	BORON	TURBIDITY (NTU)	DISSOLVED SOLIDS	CONDUCTIVITY (μ S/cm)
SL005000	7/16/96	113	22	14	52	78	7.7	43	70	3.5	< 0.1	0.2	272	492		
SL005000	8/19/96	106	21	13	52	80	7.9	43	71	2.9	< 0.1	0.2	269	498		
SL005000	9/17/96	111	23	13	49	84	8.2	42	68	2.2	< 0.1	0.2	266	480		
SL005000	10/15/96	92	19	11	44	78	8.0	37	55	2.2	< 0.1	0.1	239	427		
SL005000	11/19/96	92	19	11	42	76	7.8	33	57	2.7	< 0.1	0.2	216	409		
SL005000	12/17/96	92	19	11	43	77	7.6	33	58	2.1	< 0.1	0.2	237	415		
SL005000	1/14/97	92	19	11	45	73	7.4	33	59	3.4	< 0.1	0.2	226	415		
SL005000	2/18/97	95	20	11	41	73	7.4	33	57	3.9	< 0.1	0.2	243	408		
SL005000	3/18/97	90	18	11	42	74	7.6	33	56	3.5	< 0.1	0.1	229	400		
SL005000	4/14/97	90	18	11	43	75	7.4	33	57	2.9	< 0.1	0.1	208	404		
SL005000	5/20/97	92	19	11	43	80	7.5	33	56	2.2	< 0.1	0.2	228	401		
SL005000	6/17/97	90	18	11	44	78	7.4	33	56	2.3	< 0.1	0.2	232	404		
SL005000	7/14/97	95	20	11	46	74	8.3	32	58	2.1	< 0.1	0.1	232	398		
SL005000	8/19/97	123	26	14	52	89	8.5	35	59	0.9	< 0.1	0.2	257	456		
SL005000	9/16/97	92	19	11	39	74	9.0	30	48	0.2	< 0.1	0.2	194	363		
SL005000	10/14/97	92	19	11	39	74	8.2	27	49	1.6	< 0.1	0.2	208	371		
SL005000	11/18/97	97	19	12	44	74	8.0	29	61	1.7	< 0.1	0.1	220	412		
SL005000	12/17/97	97	19	12	52	73	7.9	30	70	2.7	< 0.1	0.1	244	456		
CA002000	2/20/96	192	45	19	54	3.4	104	8.3	129	52	1.3	0.3	406	627		
CA002000	5/13/96	180	41	19	51	3.6	97	9.1	123	53	< 0.1	0.3	386	596		
CA002000	8/19/96	189	44	19	52	3.7	101	9.0	128	54	< 0.1	0.3	390	611		
CA002000	11/19/96	161	38	16	49	99	8.0	102	50	1.2	0.3	0.4	331	560		
CA002000	2/18/97	158	37	16	48	99	7.8	98	48	1.8	0.2	0.4	316	540		
CA002000	5/19/97	142	32	15	45	107	9.1	88	43	< 0.1	0.2	0.3	325	519		
CA002000	8/18/97	161	38	16	50	90	8.6	90	46	< 0.1	0.2	0.4	313	523		
CA002000	11/17/97	138	32	14	45	85	8.1	78	45	1.0	0.2	0.3	279	480		
PE002000	2/20/96	148	28	19	88	4.9	108	8.3	63	117	0.1	0.1	405	708		
PE002000	5/13/96	144	27	18	80	4.9	107	8.9	40	114	< 0.1	0.2	397	689		
PE002000	8/20/96	146	26	20	85	5.0	104	8.9	64	121	< 0.1	0.2	396	712		
PE002000	11/18/96	135	26	17	78	108	8.1	56	102	0.1	0.2	0.2	360	663		
PE002000	2/18/97	138	27	17	80	108	7.7	60	109	0.6	0.1	0.3	355	660		
PE002000	5/20/97	134	27	16	74	120	8.4	56	101	< 0.1	0.1	0.2	370	632		
PE002000	8/18/97	147	29	18	80	104	8.4	55	96	< 0.1	0.1	0.3	340	630		
PE002000	11/17/97	131	26	16	70	101	8.1	53	91	0.2	0.1	0.2	342	609		
PY001000	2/20/96	160	37	16	47	3.1	93	8.1	107	43	2.5	0.2	339	539		
PY001000	5/14/96	118	26	13	40	2.9	75	8.2	71	47	1.4	0.2	278	446		
PY001000	8/19/96	119	26	13	42	3.1	79	9.2	63	49	0.2	0.2	10	257	430	
PY001000	11/18/96	112	25	12	38	84	7.9	55	43	1.7	0.2	0.3	2	233	414	
PY001000	2/18/97	115	26	12	39	86	7.7	57	42	2.4	0.2	0.3	2	232	427	
PY001000	5/21/97	100	22	11	39	81	7.4	48	46	2.5	0.1	0.2	2	234	401	
PY001000	8/19/97	115	26	12	42	77	8.2	52	45	1.8	0.2	0.3	1	240	417	
PY001000	11/18/97	105	22	12	43	78	8.1	45	52	1.9	< 0.1	0.2	2	237	419	
SI002000	2/21/96	92	20	11	38	2.6	69	8.2	38	45	2.3	< 0.1	0.2	222	374	
SI002000	5/14/96	94	19	11	43	2.8	66	8.4	48	55	1.1	0.1	246	408		
SI002000	8/21/96	88	18	10	35	2.8	66	8.0	31	48	2.3	< 0.1	0.1	204	353	
SI002000	11/19/96	84	17	10	31	74	7.7	25	38	2.3	< 0.1	0.1	4	187	322	
SI002000	2/19/97	90	26	6	12	97	7.4	11	10	3.5	0.1	0.1	1	152	242	
SI002000	5/19/97	91	20	10	42	77	7.3	40	52	2.5	< 0.1	0.2	7	234	399	
SI002000	8/19/97	88	19	10	38	68	8.0	28	45	1.6	< 0.1	0.2	5	199	352	
SI002000	11/18/97	84	17	10	36	74	8.1	24	46	1.6	< 0.1	0.1	1	207	355	
DMC06716	1/17/96	175	37	20	86	104	7.9	94	102	7.5	< 0.1	0.4	435	761		
DMC06716	2/21/96	102	21	12	50	57	7.2	66	53	5.0	< 0.1	0.4	264	442		
DMC06716	3/20/96	70	15	8	30	48	7.3	38	31	2.6	< 0.1	0.2	176	297		
DMC06716	4/17/96	105	22	12	50	66	7.3	66	59	3.7	< 0.1	0.3	274	465		
DMC06716	5/14/96	100	20	12	45	70	8.8	55	54	2.3	< 0.1	0.2	234	422		
DMC06716	6/19/96	62	13	7	20	48	7.0	22	21	2.1	< 0.1	0.1	135	223		
DMC06716	7/17/96	95	20	11	34	64	7.2	39	40	3.9	< 0.1	0.2	213	359		
DMC06716	8/20/96	128	28	14	55	83	7.5	65	64	6.8	< 0.1	0.3	17	322	539	
DMC06716	9/18/96	91	20	10	32	76	7.7	34	37	3.5	< 0.1	0.1	9	185	352	
DMC06716	10/16/96	72	14	9	32	73	7.8	21	40	2.2	< 0.1	< 0.1	18	180	321	
DMC06716	11/20/96	85	16	11	48	66	7.5	26	71	3.0	< 0.1	0.1	6	234	429	
DMC06716	12/18/96	48	11	5	18	45	7.1	18	17	4.0	< 0.1	0.1	18	127	196	
DMC06716	1/9/97	46	10	5	15	2.7	40	6.9	16	14	2.8	< 0.1	1	68	103	186
DMC06716	1/15/97	48	11	5	18	40	7.0	21	18	3.0	< 0.1	0.1	44	115	196	
DMC06716	2/19/97	69	16	7	24	50	7.1	38	24	3.0	< 0.1	0.2	11	165	268	
DMC06716	3/19/97	108	25	11	47	77	7.4	61	52	5.9	< 0.1	0.2	16	269	458	
DMC06716	4/16/97	82	18	9	30	70	7.2	36	35	3.5	< 0.1	0.1	12	169	338	
DMC06716	5/21/97	119	26	13	51	83	7.4	65	62	4.8	< 0.1	0.3	6	309	488	
DMC06716	6/18/97	88	19	10	34	67	7.0	35	38	3.4	< 0.1	0.2	21	187	337	
DMC06716	7/16/97	68	14	8	27	55	8.0	17	34	1.7	< 0.1	< 0.1	22	149	253	
DMC06716	8/20/97	105	22	12	44	74	8.0	38	47	3.4	< 0.1	0.2	14	228	392	
DMC06716	9/17/97	116	25	13	47	90	8.1	46	52	4.8	< 0.1	0.2	13	247	447	
DMC06716	10/15/97	96	22	10	44	68	8.0	48	47	6.2	< 0.1	0.2	18	223	405	
DMC06716	11/19/97	90	16	12	60	60	7.8	25	97	2.4	< 0.1	< 0.1	9	276	503	
DMC06716	12/17/97	116	20	16	78	69	7.8	35	120	4.1	< 0.1	0.1	10	321	620	

Table C-2
Minor Element Concentrations in the SWP

STATION	DATE	CONCENTRATION, mg/L										
		ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	MANGANESE	MERCURY	SELENIUM	SILVER
AN001000	5/22/96	< 0.001			< 0.005	< 0.005	0.120	< 0.005	0.006	< 0.001		< 0.005
AN001000	5/22/97	< 0.001			< 0.005	< 0.005	0.183	< 0.005	0.013	< 0.001		< 0.050
FR001000	5/22/96	< 0.001			< 0.005	< 0.005	0.026	< 0.005	0.005	< 0.001		< 0.005
FR001000	5/22/97	< 0.001			< 0.005	< 0.005	0.067	< 0.005	< 0.005	< 0.001		< 0.050
LD001000	5/23/96	< 0.001			< 0.005	< 0.005	0.029	< 0.005	0.016	< 0.001		< 0.005
LD001000	5/27/97	< 0.001			< 0.005	< 0.005	0.006	< 0.005	0.027	< 0.001		< 0.050
LD001000	6/26/97						0.028		< 0.005			
LD001000	7/29/97						0.066		0.042			
LD001000	8/29/97						0.055		0.189			
LD001000	9/24/97						0.059		0.178			
TA001000	1/17/96	< 0.001			< 0.005	< 0.005	0.015	< 0.005	0.006	< 0.001		< 0.005
TA001000	3/20/96	< 0.001			< 0.005	< 0.005	0.021	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	4/17/96	< 0.001			< 0.005	< 0.005	0.009	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	5/15/96	< 0.001			< 0.005	< 0.005	0.012	< 0.005	0.006	< 0.001		< 0.005
TA001000	6/19/96	< 0.001			< 0.005	< 0.005	0.010	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	7/17/96	< 0.001			< 0.005	< 0.005	0.005	< 0.005	0.005	< 0.001		< 0.005
TA001000	8/20/96	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005
TA001000	9/18/97	< 0.001		0.000	< 0.005	< 0.005	0.010	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	10/16/96	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.001	< 0.005	< 0.005
TA001000	11/20/96	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.010	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	12/18/96	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.013	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	1/15/97	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.024	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	2/19/97	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005
TA001000	3/19/97	< 0.001		0.000	< 0.005	< 0.005	0.005	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	4/16/97	< 0.001		0.000	< 0.005	< 0.005	0.017	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	5/21/97	< 0.001		0.000	< 0.005	< 0.005	0.026	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	6/18/97	< 0.001		< 0.005	< 0.005	< 0.005	0.005	< 0.005	< 0.005	< 0.001		< 0.005
TA001000	7/16/97	< 0.001		0.000	< 0.005	0.001	0.005	< 0.001	< 0.005	< 0.001		< 0.005
TA001000	8/20/97	< 0.001	< 0.050	< 0.001	< 0.005	0.001	0.006	< 0.001	< 0.005	< 0.0002	< 0.001	< 0.001
TA001000	9/17/97	< 0.001	0.000	0.000	< 0.005	0.001	0.010	< 0.001	< 0.005	< 0.001		< 0.050
TA001000	10/15/97	< 0.001	< 0.050	< 0.001	< 0.005	< 0.001	0.005	< 0.001	< 0.005	< 0.001	< 0.001	< 0.005
TA001000	11/19/97	< 0.001	< 0.050	< 0.001	< 0.005	< 0.001	0.005	< 0.001	< 0.005	< 0.0002	< 0.001	< 0.001
TA001000	12/17/97	< 0.001	0.000	0.000	< 0.005	< 0.001	0.009	< 0.001	0.015	< 0.001		< 0.005
TF001000	5/15/96	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.013	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005
TF001000	8/20/96	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005
TF001000	11/20/96	< 0.001	0.050	< 0.005	< 0.005	< 0.005	0.007	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005
TF001000	2/19/97	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.016	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005
TF001000	5/21/97	< 0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.006	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.050
TF001000	8/20/97	< 0.001	< 0.050	< 0.001	< 0.005	< 0.001	0.005	< 0.001	< 0.005	< 0.0002	< 0.001	< 0.001
TF001000	11/19/97	< 0.001	< 0.050	< 0.001	< 0.005	< 0.001	0.005	< 0.001	< 0.005	< 0.0002	< 0.001	< 0.001
KG000000	1/17/96	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.101	< 0.005	0.005	< 0.0010	< 0.001	< 0.005
KG000000	2/21/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.111	< 0.005	0.005	< 0.0010	< 0.001	< 0.005
KG000000	3/20/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.086	< 0.005	0.063	< 0.0010	< 0.001	< 0.005
KG000000	4/17/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.014	< 0.005	0.027	< 0.0010	< 0.001	< 0.005
KG000000	5/15/96	0.003	0.053	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.016	< 0.0010	< 0.001	< 0.005
KG000000	6/19/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.030	< 0.0010	< 0.001	< 0.005
KG000000	7/17/96	0.003	< 0.050	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.011	< 0.0010	< 0.001	< 0.005
KG000000	8/21/96	0.003	< 0.050	< 0.005	< 0.005	< 0.005	0.006	< 0.005	0.010	< 0.0010	< 0.001	< 0.005
KG000000	9/18/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.010	< 0.005	0.015	< 0.0010	< 0.001	< 0.005
KG000000	10/2/96						0.012		0.014			< 0.010
KG000000	10/9/96						0.005		0.014			< 0.010
KG000000	10/16/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.006	< 0.005	0.022	< 0.0010	< 0.001	< 0.005
KG000000	10/23/96						< 0.005		0.012			< 0.010
KG000000	10/30/96						0.010		0.024			< 0.010
KG000000	11/5/96						0.009		0.023			< 0.010
KG000000	11/13/96						< 0.005		0.015			< 0.010
KG000000	11/20/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.021	< 0.005	0.022	< 0.0010	< 0.001	< 0.005
KG000000	11/25/96						0.026		0.032			< 0.010
KG000000	12/4/96						0.015		0.024			< 0.010
KG000000	12/9/96						0.021		0.025			< 0.010
KG000000	12/18/96	0.002	0.057	< 0.005	< 0.005	< 0.005	0.066	< 0.005	0.023	< 0.0010	< 0.001	< 0.005
KG000000	12/23/96						0.517		0.358			0.438
KG000000	12/30/96						0.088		0.005			< 0.010
KG000000	1/7/97						0.095		0.034			0.011
KG000000	1/15/97	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.155	< 0.005	0.025	< 0.0010	< 0.001	< 0.005
KG000000	1/22/97						0.126		0.024			0.011
KG000000	1/29/97						0.108		0.008			0.022
KG000000	2/5/97						0.107		0.035			0.010
KG000000	2/10/97						0.105		0.060			< 0.010
KG000000	2/19/97	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.087	< 0.005	0.075	< 0.0010	< 0.001	< 0.005
KG000000	2/26/97						0.064		0.042			< 0.010
KG000000	3/5/97						0.062		0.044			< 0.010
KG000000	3/12/97						0.042		0.039			< 0.010
KG000000	3/19/97	0.002	0.051	< 0.005	< 0.005	< 0.005	0.012	< 0.005	0.033	< 0.0010	< 0.001	< 0.005
KG000000	3/26/97						0.016		0.031			< 0.010
KG000000	4/2/97						0.008		0.043			< 0.010
KG000000	4/8/97						0.008		0.019			0.010
KG000000	4/16/97	0.002	0.064	< 0.005	< 0.005	< 0.005	< 0.005		0.015	< 0.0010	< 0.001	< 0.005
KG000000	4/23/97						< 0.005		0.017			< 0.010
KG000000	4/28/97						< 0.005		0.114			< 0.010
KG000000	5/7/97											

Table C-2 (Con't)
Minor Element Concentrations in the SWP

STATION	DATE	CONCENTRATION, mg/L												
		ARSENIC	BARIUM	CADMIUM	CHROMIUM	COPPER	IRON	LEAD	MANGANESE	MERCURY	SELENIUM	SILVER	ZINC	ALUMINUM
KG000000	6/4/97						0.027		0.008					< 0.010
KG000000	6/1/97						0.026		0.008					< 0.010
KG000000	6/18/97	0.002	0.050	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.013	< 0.0010	< 0.001	< 0.005	< 0.050	< 0.010
KG000000	6/25/97								0.010					< 0.010
KG000000	7/2/97								0.022					< 0.010
KG000000	7/16/97	0.003	< 0.050	< 0.001	< 0.005	0.002	< 0.005	< 0.001	0.017	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KG000000	8/20/97	0.003	< 0.050	< 0.001	< 0.005	0.002	0.013	< 0.001	0.023	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KG000000	9/17/97	0.003	0.066	< 0.001	< 0.005	0.002	0.005	< 0.001	0.014	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KG000000	10/15/97	0.003	< 0.050	< 0.001	0.006	0.002	< 0.005	< 0.001	0.015	< 0.0002	< 0.001	< 0.001	< 0.005	< 0.010
KG000000	11/19/97	0.002	0.065	< 0.001	< 0.005	0.003	0.015	< 0.001	0.012	< 0.0002	< 0.001	< 0.001	< 0.005	< 0.010
KG000000	12/17/97	0.002	0.054	< 0.001	0.007	0.004	0.060	< 0.001	0.018	< 0.0002	< 0.001	< 0.001	< 0.005	< 0.010
KG002111	2/21/96	0.002	< 0.050	< 0.005	< 0.005	0.005	0.070	< 0.005	0.038	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KG002111	5/15/96	0.003	0.059	< 0.005	< 0.005	0.005	< 0.005	< 0.005	0.006	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KG002111	8/21/96	0.003	< 0.050	< 0.005	< 0.005	< 0.005	0.011	< 0.005	0.006	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KG002111	11/20/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.015	< 0.005	0.007	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.005
KG002111	2/19/97	0.003	< 0.050	< 0.005	< 0.005	0.005	0.075	< 0.005	0.016	< 0.0010	< 0.001	< 0.005	0.016	< 0.010
KG002111	5/21/97	0.003	< 0.050	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.005	< 0.0010	< 0.001	< 0.005	< 0.050	< 0.010
KG002111	8/20/97	0.003	< 0.050	< 0.001	< 0.005	0.002	0.007	< 0.001	0.006	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KG002111	11/19/97	0.002	0.059	< 0.001	0.005	0.002	0.014	< 0.001	0.005	< 0.0002	< 0.001	< 0.001	< 0.005	< 0.010
DV000000	10/16/96	0.002	0.070	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005	0.437	< 0.010
DV000000	2/19/97	0.001	0.052	< 0.005	< 0.005	< 0.005	0.009	< 0.005	0.005	< 0.0010	< 0.001	< 0.005	0.232	< 0.010
DV000000	6/18/97	< 0.001	0.064	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.0010	< 0.001	< 0.005	< 0.050	< 0.010
DV000000	9/17/97	0.002	0.076	< 0.001	< 0.005	0.002	< 0.005	< 0.001	0.005	< 0.0002	< 0.001	< 0.001	0.137	< 0.010
DV000000	10/15/97	0.003	0.073	< 0.001	0.008	0.002	< 0.005	< 0.001	0.005	< 0.0002	< 0.001	< 0.001	0.126	< 0.010
DV001000	9/18/96	0.002	0.073	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.028	< 0.0010	< 0.001	< 0.005	0.025	< 0.010
DV001000	11/20/96	0.002	0.078	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.006	< 0.0010	< 0.001	< 0.005	0.240	< 0.010
DV001000	12/18/96	0.002	0.082	< 0.005	< 0.005	< 0.005	0.006	< 0.005	0.005	< 0.0010	< 0.001	< 0.005	0.282	< 0.010
DV001000	1/15/97	0.001	0.062	< 0.005	< 0.005	< 0.005	0.007	< 0.005	0.005	< 0.0010	< 0.001	< 0.005	0.129	< 0.010
KB001638	4/16/97	0.001	< 0.050	< 0.005	< 0.005	0.015	0.009	< 0.005	0.012	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KB001638	5/21/97	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.008	< 0.005	0.010	< 0.0010	< 0.001	< 0.005	< 0.050	< 0.010
KB001638	6/18/97	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.012	< 0.0010	< 0.001	< 0.005	< 0.050	< 0.010
KB001638	7/16/97	0.002	< 0.050	< 0.001	< 0.005	0.008	0.006	< 0.001	0.008	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB001638	8/20/97	0.003	< 0.050	< 0.001	< 0.005	0.003	0.006	< 0.001	0.005	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB001638	9/17/97	0.002	< 0.050	< 0.001	< 0.005	0.003	0.009	< 0.001	0.005	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB001638	10/15/97	0.002	< 0.050	< 0.001	< 0.005	0.003	< 0.005	< 0.001	0.008	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB001638	11/19/97	0.002	< 0.050	< 0.001	< 0.005	0.002	0.009	< 0.001	0.005	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB001638	12/17/97	0.002	< 0.050	< 0.001	< 0.005	0.004	0.029	< 0.001	0.007	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB004207	2/21/96	0.001	< 0.050	< 0.005	< 0.005	0.005	0.013	< 0.005	0.012	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KB004207	3/20/96	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.008	< 0.005	0.007	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KB004207	5/15/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.005	< 0.005	0.014	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KB004207	8/21/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.039	< 0.005	0.009	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KB004207	9/18/96	0.002	0.055	< 0.005	< 0.005	< 0.005	0.010	< 0.005	0.011	< 0.0010	< 0.001	< 0.005	0.012	< 0.010
KB004207	10/16/96	0.002	0.058	< 0.005	< 0.005	< 0.005	0.006	< 0.005	0.005	< 0.0010	< 0.001	< 0.005	0.013	< 0.010
KB004207	11/20/96	0.003	< 0.050	< 0.001	< 0.005	< 0.005	0.008	< 0.005	0.010	< 0.0010	< 0.001	< 0.005	0.011	< 0.005
KB004207	1/15/97	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.033	< 0.005	0.025	< 0.0010	< 0.001	< 0.005	< 0.005	< 0.010
KB004207	2/19/97	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.019	< 0.005	0.005	< 0.0010	< 0.001	< 0.005	0.016	< 0.010
KB004207	5/21/97	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.007	< 0.005	0.007	< 0.0010	< 0.001	< 0.005	0.050	< 0.010
KB004207	8/20/97	0.002	< 0.050	< 0.001	< 0.005	< 0.003	0.015	< 0.001	0.020	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB004207	9/17/97	0.002	0.059	< 0.001	< 0.005	< 0.003	0.010	< 0.001	0.008	< 0.0002	< 0.001	< 0.001	< 0.050	< 0.010
KB004207	10/15/97	0.002	0.058	< 0.001	< 0.006	0.002	0.027	< 0.001	0.008	< 0.0002	< 0.001	< 0.001	0.007	< 0.010
KB004207	11/19/97	0.002	< 0.050	< 0.001	< 0.005	0.003	0.027	< 0.001	0.015	< 0.0002	< 0.001	< 0.001	< 0.005	< 0.010
KA000000	1/7/97	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.057	< 0.005	0.127	< 0.0010	< 0.001	< 0.005	0.005	< 0.021
KA000000	2/19/97	0.001	< 0.050	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	0.022	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	1/17/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.083	< 0.005	0.012	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	2/21/96	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.045	< 0.005	0.033	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	3/20/96	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.018	< 0.005	0.017	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	4/17/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.015	< 0.005	0.034	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	5/15/96	0.001	< 0.050	< 0.005	< 0.005	< 0.005	0.006	< 0.005	0.029	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	6/19/96	0.002	< 0.050	< 0.005	< 0.005	< 0.005	0.014	< 0.005	0.024	< 0.0010	< 0.001	< 0.005	0.005	< 0.010
KA000331	7/17/96	0.002	< 0.050	< 0										

Table C-2 (Con't)
Minor Element Concentrations in the SWP

Table C-2 (Con't)
Minor Element Concentrations in the SWP

Table C-3
TOC, DOC, UV 254, Bromide, TSS, and SVS Concentrations in the SWP

STATION	DATE	TOTAL ORGANIC CARBON (mg/L)	DISS. ORGANIC CARBON (mg/L)	UV 254 (1/cm)	BROMIDE (mg/L)	SUSPENDED SOLIDS (mg/L)	SUSPENDED VOLATILE SOLIDS (mg/L)
TA001000	5/15/96				< 0.01	6	2
TA001000	8/20/96				< 0.01	7	2
TA001000	11/20/96				< 0.01	4	< 1
TA001000	2/19/97				< 0.01	28	3
TA001000	5/21/97				< 0.01	8	2
TA001000	8/20/97				< 0.01		
TA001000	11/19/97				< 0.01	8	2
TF001000	8/20/96				< 0.01	2	< 1
KG000000	1/17/96	12.5			0.02		
KG000000	2/21/96	14.5			0.02	105	10
KG000000	3/20/96	13.1			0.03	42	10
KG000000	4/17/96	7.4			0.06		
KG000000	5/15/96	4.5			0.08	28	4
KG000000	6/19/96	4.7			0.05	20	2
KG000000	7/17/96	4.3			0.04	27	4
KG000000	8/21/96	4.9			0.04	28	4
KG000000	9/18/96	4.9			0.04	22	3
KG000000	10/2/96	5.4	4.5	0.137			
KG000000	10/9/96	4.0	3.5	0.106			
KG000000	10/16/96	4.4			0.04	32	2
KG000000	10/23/96	4.2	3.8	0.115			
KG000000	10/30/96	4.8	4.0	0.120			
KG000000	11/5/96	5.0	4.7	0.128			
KG000000	11/13/96	4.0	3.4	0.093			
KG000000	11/20/96	6.6	5.9	0.156	0.05	14	3
KG000000	11/25/96	6.6	5.6	0.157			
KG000000	12/4/96	5.6	4.6	0.134			
KG000000	12/9/96	6.0	5.5	0.159			
KG000000	12/18/96	11.0	10.0	0.309	0.05	25	4
KG000000	12/23/96	18.4	12.2	0.414			
KG000000	12/30/96	19.9	13.1	0.448			
KG000000	1/7/97	14.3	11.7	0.426			
KG000000	1/15/97	14.8	11.9	0.454	0.01	26	5
KG000000	1/22/97	14.1	12.2	0.440			
KG000000	1/29/97	11.8	8.1	0.284			
KG000000	2/5/97	12.0	8.8	0.321			
KG000000	2/10/97	12.1	9.4	0.355			
KG000000	2/19/97	12.1	9.8	0.358	0.05	24	7
KG000000	2/26/97	12.0	10.1	0.335			
KG000000	3/5/97	10.8	9.3	0.302			
KG000000	3/12/97	8.9	7.3	0.254			
KG000000	3/19/97	7.9	6.3	0.220	0.05	35	7
KG000000	3/26/97	7.2	6.7	0.205			
KG000000	4/2/97	7.2	5.8				
KG000000	4/8/97	6.2	5.8	0.179			
KG000000	4/16/97	6.1	5.6	0.164	0.08	48	5
KG000000	4/23/97	5.6	5.6	0.150			
KG000000	4/28/97	4.4	4.0	0.117			
KG000000	5/7/97	4.1	3.6	0.106			
KG000000	5/14/97	5.9	4.2	0.120			
KG000000	5/21/97	4.7	3.9	0.000	0.06	47	6
KG000000	5/27/97	5.9	5.1	0.156			
KG000000	6/4/97	5.6	4.8	0.144			
KG000000	6/11/97	5.3	4.3	0.094			
KG000000	6/18/97	4.0	3.7	0.105	0.05	59	6
KG000000	6/25/97	4.4	3.7	0.117			
KG000000	7/2/97	4.5	3.4	0.106			
KG000000	7/16/97	4.7	3.6		0.04	54	9
KG000000	8/20/97	6.0	4.9		0.03	31	4
KG000000	9/17/97	5.8	5.0	0.154	0.04	34	4
KG000000	10/15/97	5.5	3.4	0.095	0.20	39	4
KG000000	11/19/97	7.0	6.0	0.069	0.09	39	7
KG000000	12/17/97	11.9	9.5	0.318	0.05	58	10
KG002111	2/21/96				0.05		
KG002111	5/15/96				0.10		
KG002111	8/21/96				0.04		
KG002111	11/20/96				0.04		
KG002111	2/19/97				0.05		
KG002111	5/21/97				0.06		
KG002111	8/20/97				0.03		
KG002111	11/19/97				0.11		
DV000000	10/16/96				0.02	2	< 1
DV000000	2/19/97				0.01	8	1
DV000000	6/18/97				0.02	3	< 1
DV000000	9/17/97				2		< 1
DV000000	10/15/97				2		1
DV001000	9/18/96				2		< 1
DV001000	11/20/96				3		1
DV001000	12/18/96				8		< 1
DV001000	1/15/97				0.02	24	4
KB001638	4/16/97	3.6			0.09	4	< 1
KB001638	5/21/97	3.9			0.16	21	4
KB001638	6/18/97	4.0			0.11	6	1
KB001638	7/16/97	3.2			0.09	8	< 1
KB001638	8/20/97	3.2			0.09	9	2
KB001638	9/17/97	3.0			0.09	10	3
KB001638	10/15/97	3.0			0.38	< 1	< 1
KB001638	11/19/97	3.0			0.35	6	< 1
KB001638	12/17/97	4.4			0.46	12	4
KB004207	2/21/96				0.03		
KB004207	3/20/96				0.02		

Table C-3 (Con't)
TOC, DOC, UV 254, Bromide, TSS, and SVS Concentrations in the SWP

STATION	DATE	TOTAL ORGANIC CARBON (mg/L)	DISS. ORGANIC CARBON (mg/L)	UV 254 (1/cm)	BROMIDE (mg/L)	SUSPENDED SOLIDS (mg/L)	SUSPENDED VOLATILE SOLIDS (mg/L)
KB004207	5/15/96				0.13		
KB004207	8/21/96				0.11		
KB004207	9/18/96				0.05		
KB004207	10/16/96				0.05		
KB004207	11/20/96				0.03		
KB004207	12/18/96				0.11		
KB004207	1/15/97				0.05		
KB004207	2/19/97				0.05		
KB004207	5/21/97				0.15		
KB004207	8/20/97				0.09		
KB004207	9/17/97				0.06		
KB004207	10/15/97				0.27		
KB004207	11/19/97				0.35		
KA000000	2/21/96				0.08		
KA000000	5/15/96				0.15		
KA000000	8/21/96				0.11		
KA000000	11/20/96				0.20		
KA000000	1/7/97	5.9			0.02		
KA000000	2/19/97				0.04		
KA000000	5/21/97				0.19		
KA000000	8/20/97				0.10		
KA000000	11/19/97				0.34		
KA000331	1/17/96	5.5			0.07	50	7
KA000331	2/21/96	5.2			0.11	5	< 1
KA000331	3/20/96	3.7			0.08	7	2
KA000331	4/17/96	3.8			0.13	2	< 1
KA000331	5/15/96	3.0			0.13	2	< 1
KA000331	6/19/96	2.9			0.07	17	3
KA000331	7/17/96	2.7			0.04	11	2
KA000331	8/21/96	2.7			0.11	8	2
KA000331	9/18/96	2.8			0.08	7	< 1
KA000331	10/16/96	2.7			0.13	4	< 1
KA000331	11/20/96	3.1			0.21	4	< 1
KA000331	12/18/96	6.7			0.14	8	1
KA000331	1/15/97	4.6			0.04	14	3
KA000331	2/19/97	3.6			0.05	4	2
KA000331	3/19/97	3.5			0.11	4	2
KA000331	4/16/97	3.5			0.09	6	1
KA000331	5/21/97	3.6			0.16	3	< 1
KA000331	6/18/97	3.3			0.10	26	3
KA000331	7/16/97	3.2			0.09	16	3
KA000331	8/20/97	3.1			0.10	2	< 1
KA000331	9/17/97	2.7			0.09	5	< 1
KA000331	10/15/97	2.8			0.39	3	< 1
KA000331	11/19/97	3.0			0.36	15	2
KA000331	12/17/97	4.4			0.44	8	2
KA006633	2/20/96	5.5					
KA006633	5/14/96	3.9					
KA006633	8/20/96	2.8					
KA006633	11/20/96	3.2					
KA006633	1/19/97	4.1					
KA006633	5/21/97	3.9					
KA006633	8/20/97	2.9					
KA006633	11/19/97	2.7					
KA007089	1/17/96	5.2			0.15		
KA007089	2/21/96	5.0			0.11		
KA007089	3/20/96	3.9			0.10		
KA007089	4/17/96	3.7			0.16		
KA007089	5/14/96	3.6			0.19		
KA007089	6/19/96	3.2			0.10		
KA007089	7/17/96	3.2			0.16		
KA007089	8/20/96	2.9			0.15		
KA007089	9/18/96	2.9			0.09		
KA007089	10/16/96	3.0			0.11		
KA007089	11/20/96	3.0			0.16		
KA007089	12/18/96	5.8			0.14		
KA007089	1/15/97	4.7			0.06		
KA007089	2/19/97	4.4			0.05		
KA007089	3/19/97	3.4			0.10		
KA007089	4/16/97	3.5			0.12		
KA007089	5/21/97	2.9			0.17		
KA007089	6/18/97	3.2			0.14		
KA007089	7/16/97	3.0			0.16		
KA007089	8/19/97	3.1			0.12		
KA007089	9/17/97	2.9			0.09		
KA007089	10/15/97	2.7			0.29		
KA007089	11/19/97	2.8			0.34		
KA007089	12/17/97	4.3			0.43		
KA014323	1/6/97	4.1				16	
KA017226	1/17/96					10	1
KA017226	2/21/96	6.2			0.12	18	2
KA017226	3/20/96					12	3
KA017226	4/17/96					22	2
KA017226	5/14/96	3.6			0.21	23	4
KA017226	6/19/96					33	3
KA017226	7/17/96					21	3
KA017226	8/21/96	2.9			0.16	16	2
KA017226	9/18/96					18	2
KA017226	10/16/96					12	< 1
KA017226	11/20/96	3.1			0.14	2	1
KA017226	12/17/96					9	< 1

Table C-3 (Con't)
TOC, DOC, UV 254, Bromide, TSS, and SVS Concentrations in the SWP

STATION	DATE	TOTAL ORGANIC CARBON (mg/L)	DISS. ORGANIC CARBON (mg/L)	UV 254 (1/cm)	BROMIDE (mg/L)	SUSPENDED SOLIDS (mg/L)	SUSPENDED VOLATILE SOLIDS (mg/L)
KA017226	1/14/97				0.06	21	4
KA017226	2/19/97	4.4				3	< 1
KA017226	3/19/97					36	5
KA017226	4/16/97					16	2
KA017226	5/21/97	2.9			0.17	31	4
KA017226	6/18/97					27	4
KA017226	7/15/97					16	2
KA017226	8/20/97	3.3			0.15	11	2
KA017226	9/17/97					21	2
KA017226	10/15/97					17	1
KA017226	11/19/97	2.7			0.39	8	1
KA017226	12/17/97					10	2
KA020794	1/9/97					10	< 1
KA021031	1/13/97					6	2
KA021031	1/28/97					4	< 1
KA021031	2/11/97					5	3
KA024454	1/16/96					12	1
KA024454	2/20/96					127	8
KA024454	3/19/96					10	2
KA024454	4/16/96					261	16
KA024454	5/14/96					1030	85
KA024454	6/18/96					83	7
KA024454	7/16/96					234	13
KA024454	8/20/96					38	4
KA024454	9/17/96					155	11
KA024454	10/15/96					70	2
KA024454	11/19/96					58	6
KA024454	12/17/96					67	6
KA024454	1/14/97					29	4
KA024454	2/18/97					13	2
KA024454	3/18/97					29	4
KA024454	4/15/97					44	4
KA024454	5/20/97					35	4
KA024454	6/17/97					137	7
KA024454	7/15/97					35	4
KA024454	8/19/97					15	3
KA024454	9/16/97					22	2
KA024454	10/14/97					6	< 1
KA024454	11/18/97					8	< 1
KA024454	12/16/97					8	2
KA030341	1/17/96	3.1			0.18	13	4
KA030341	1/17/96					0.15	
KA030341	2/21/96	5.9				15	2
KA030341	2/21/96					10	
KA030341	3/20/96	4.8			0.12		
KA030341	3/20/96					71	
KA030341	4/17/96	3.9				74	
KA030341	4/17/96					61	
KA030341	5/15/96	4.0			0.20		
KA030341	5/15/96					0.16	
KA030341	6/19/96					0.14	
KA030341	6/19/96	3.4				33	
KA030341	7/17/96	8.1				56	
KA030341	8/20/96					0.16	
KA030341	8/21/96	3.2				0.11	
KA030341	9/18/96	3.3				73	
KA030341	10/15/96	2.7			0.08	11	
KA030341	11/20/96	2.8			0.13	9	
KA030341	12/18/96	2.7			0.17	7	
KA030341	1/13/97	3.5			0.19	6	
KA030341	2/19/97	4.1			< 0.01	3	
KA030341	3/19/97	3.6			0.08	66	
KA030341	4/16/97	4.8			0.14	9	
KA030341	5/21/97	3.3			0.17	39	
KA030341	6/18/97	3.0			0.16	73	
KA030341	7/16/97	3.2			0.12	46	
KA030341	8/20/97	3.5			0.16	52	
KA030341	9/17/97	2.8			0.10	66	
KA030341	10/15/97	2.5			0.069	40	
KA030341	11/19/97	2.5			0.072	0.38	
KA030341	12/17/97	2.7				16	
KA036690	3/13/97	4.0			0.33	32	
KA037394	3/13/97	4.5					
KA040341	2/21/96	5.0					
KA040341	5/15/96	4.0					
KA040341	8/21/96	3.3					
KA040341	11/20/96	4.0					
KA040341	2/19/97	3.6					
KA040341	3/13/97	5.1					
KA040341	5/21/97	3.6			0.16	100	
KA040341	8/20/97	3.5					
KA040341	11/19/97	2.7		0.070			
KA041288	1/17/96	3.0			0.13		
KA041288	2/21/96	6.4			0.08		
KA041288	3/20/96	3.8			0.12		
KA041288	4/17/96	4.5			0.10		
KA041288	5/15/96	4.0			0.16	8	
KA041288	6/19/96	3.4			0.15		
KA041288	7/17/96	3.7				7	
KA041288	8/21/96	0.0					2
KA041288	8/21/96	3.1			0.14		

Table C-3 (Con't)
TOC, DOC, UV 254, Bromide, TSS, and SVS Concentrations in the SWP

STATION	DATE	TOTAL ORGANIC CARBON (mg/L)	DISS. ORGANIC CARBON (mg/L)	UV 254 (1/cm)	BROMIDE (mg/L)	SUSPENDED SOLIDS (mg/L)	SUSPENDED VOLATILE SOLIDS (mg/L)
KA041288	9/18/96	2.7			0.13		
KA041288	10/16/96	2.7			0.11	2	< 1
KA041288	11/20/96	2.9			0.11	5	2
KA041288	12/18/96	3.0			0.13		
KA041288	1/13/97	4.2			0.10		
KA041288	2/19/97	1.8			< 0.01	3	< 1
KA041288	3/19/97	4.4			0.09		
KA041288	4/16/97	3.6			0.10		
KA041288	5/21/97	3.2			0.15	6	2
KA041288	6/18/97				0.16	4	2
KA041288	7/16/97	3.0			0.15		
KA041288	8/20/97	2.8			0.13		
KA041288	9/17/97	2.7			0.14	2	< 1
KA041288	10/15/97	2.5		0.068	0.19		
KA041288	11/19/97	2.5		0.067	0.20	2	< 1
KA041288	12/17/97	2.4		0.066	0.17		
KC000934	6/18/96					57	4
KC000934	7/16/96					49	5
KC000934	8/20/96					180	16
KC000934	9/17/96					32	3
KC000934	10/15/96					55	3
KC000934	11/14/96					20	3
KC000934	12/17/96					47	6
KC000934	1/14/97					3	2
KC000934	2/18/97					23	4
KC000934	3/18/97					107	14
KC000934	4/15/97					25	4
KC000934	5/20/97					41	4
KC000934	6/17/97					142	11
KC000934	7/15/97					60	5
KC000934	8/19/97					10	3
KC000934	9/16/97					4	1
KC000934	10/14/97					14	2
KC000934	11/18/97					7	2
KC000934	12/15/97					4	2
CA002000	2/20/96	3.4					
CA002000	5/10/96	5.7					
CA002000	8/19/96	4.9					
CA002000	11/19/96	4.3					
CA002000	2/18/97	2.9					
CA002000	5/19/97	5.8			6		4
CA002000	8/18/97	4.3			5		1
CA002000	11/17/97	2.8		0.175			
PY001000	5/21/97	0.0			2		< 1
DMC06716	1/17/96	4.0			0.29		
DMC06716	2/21/96	4.0			0.15		
DMC06716	3/20/96	3.6			0.08		
DMC06716	4/17/96	3.5			0.16		
DMC06716	5/14/96	3.4			0.16		
DMC06716	6/19/96	3.5			0.06		
DMC06716	8/20/96	3.0			0.22		
DMC06716	9/18/96	3.0			0.12		
DMC06716	10/16/96	3.0			0.12		
DMC06716	11/20/96	3.2			0.21		
DMC06716	12/18/96	5.2			0.05		
DMC06716	1/9/97	5.8			0.04	98	11
DMC06716	1/15/97	5.4			0.04		
DMC06716	2/19/97	4.3			0.06		
DMC06716	3/19/97	3.9			0.15		
DMC06716	4/16/97	4.0			0.10		
DMC06716	5/21/97	3.2			0.18		
DMC06716	6/18/97	3.2			0.11		
DMC06716	7/16/97	2.8			0.10		
DMC06716	8/20/97	3.1			0.14		
DMC06716	9/17/97	2.9			0.15		
DMC06716	10/15/97	3.0			0.20		
DMC06716	11/19/97	4.4			0.37		
DMC06716	12/17/97	4.2			0.42		
DMC06803	7/17/96	3.2			0.12		

Table C-4
Nutrient Concentrations in the SWP

STATION	DATE	ORGANIC	NITRATE+	DISSOLVED	ORTHO-	TOTAL
		NITROGEN	NITRITE	AMMONIA	PHOSPHATE	
AN001000	5/22/96	0.3	< 0.01	< 0.01	< 0.01	0.02
AN001000	5/22/97	0.3	< 0.01	< 0.01	< 0.01	0.03
FR001000	5/22/96	0.2	< 0.01	< 0.01	< 0.01	< 0.01
FR001000	5/22/97	0.2	< 0.01	< 0.01	< 0.01	0.01
LD001000	5/23/96	0.3	< 0.01	< 0.01	< 0.01	0.02
LD001000	5/27/97	0.3	< 0.01	< 0.01	< 0.01	0.01
OR001000	4/17/96	0.2	< 0.01	< 0.01	< 0.01	0.12
OR001000	5/15/96	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01
OR001000	6/19/96	0.2	< 0.01	< 0.01	< 0.01	< 0.01
OR001000	7/17/96	< 0.1	0.04	< 0.01	< 0.01	< 0.01
OR001000	8/20/96	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01
OR001000	9/18/96	0.2	< 0.01	< 0.01	< 0.01	< 0.01
OR001000	10/16/96	< 0.1	0.02	< 0.01	< 0.01	0.06
OR001000	11/20/96	0.3	0.03	< 0.01	< 0.01	0.04
OR001000	4/16/97	0.2	< 0.01	< 0.01	< 0.01	0.02
OR001000	5/21/97	0.1	0.02	< 0.01	< 0.01	0.01
OR001000	6/18/97	0.1	< 0.01	< 0.01	< 0.01	< 0.01
OR001000	7/16/97	0.2	< 0.01	< 0.01	< 0.01	< 0.01
OR001000	8/20/97	0.2	< 0.01	< 0.01	< 0.01	0.01
OR001000	9/17/97	0.2	< 0.01	< 0.01	< 0.01	< 0.01
TA001000	1/17/96	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01
TA001000	4/17/96	< 0.1	< 0.01	< 0.01	< 0.01	0.01
TA001000	4/20/96	< 0.1	0.02	< 0.01	< 0.01	0.02
TA001000	5/15/96	0.1	< 0.01	< 0.01	< 0.01	0.01
TA001000	6/19/96	0.1	< 0.01	< 0.01	< 0.01	0.01
TA001000	7/17/96	0.1	< 0.01	< 0.01	< 0.01	< 0.01
TA001000	8/20/96	0.1	< 0.01	< 0.01	< 0.01	< 0.01
TA001000	9/18/96	< 0.1	< 0.01	< 0.01	< 0.01	< 0.01
TA001000	10/16/96	< 0.1	0.02	< 0.01	< 0.01	0.06
TA001000	11/20/96	0.2	0.03	< 0.01	0.01	< 0.01
TA001000	12/18/96	0.1	0.07	< 0.01	< 0.01	< 0.01
TA001000	1/15/97	0.3	0.04	< 0.01	< 0.01	0.18
TA001000	2/19/97	0.2	0.03	< 0.01	< 0.01	0.09
TA001000	3/19/97	0.2	< 0.01	0.01	< 0.01	0.06
TA001000	4/16/97	0.2	< 0.01	< 0.01	< 0.01	0.04
TA001000	5/21/97	0.2	< 0.01	< 0.01	< 0.01	0.02
TA001000	6/18/97	0.2	< 0.01	< 0.01	< 0.01	0.02
TA001000	7/16/97	0.2	< 0.01	< 0.01	< 0.01	0.02
TA001000	8/20/97	0.2	0.01	< 0.01	< 0.01	0.02
TA001000	9/17/97	0.2	< 0.01	< 0.01	0.01	0.01
TA001000	10/15/97	0.1	< 0.01	0.01	< 0.01	0.02
TA001000	11/17/97	0.1	0.02	< 0.01	< 0.01	0.02
TA001000	12/17/97	0.2	< 0.01	< 0.01	< 0.01	0.02
KG000000	1/17/96	2.0	3.50	0.05	0.10	0.43
KG000000	2/21/96	2.0	1.30	0.08	0.08	0.32
KG000000	3/20/96	1.1	0.13	0.04	0.11	0.29
KG000000	4/17/96	0.7	0.36	0.03	0.07	0.15
KG000000	5/15/96	0.5	0.40	0.03	0.09	0.16
KG000000	6/19/96	0.5	0.40	0.02	0.10	0.18
KG000000	7/17/96	0.6	0.36	0.02	0.10	0.18
KG000000	8/21/96	0.6	0.23	0.01	0.10	0.19
KG000000	9/18/96	0.6	0.22	0.02	0.12	0.20
KG000000	10/16/96	0.4	0.15	0.02	0.08	0.17
KG000000	11/20/96	0.6	0.23	0.03	0.05	0.14
KG000000	12/18/96	1.0	0.52	0.05	0.10	0.20
KG000000	1/15/97	1.3	0.15	0.05	0.12	0.30
KG000000	2/19/97	1.1	0.11	0.07	0.15	0.35
KG000000	3/19/97	0.8	0.37	0.04	0.08	0.21
KG000000	4/16/97	0.7	0.34	0.03	0.09	0.17
KG000000	5/21/97	0.6	0.53	0.03	0.12	0.20
KG000000	6/18/97	0.6	0.61	0.02	0.11	0.21
KG000000	7/16/97	0.6	0.30	0.03	0.11	0.21
KG000000	8/20/97	0.6	0.15	< 0.01	0.10	0.21
KG000000	9/17/97	0.7	0.18	0.04	0.10	0.18
KG000000	10/15/97	0.4	0.26	0.02	0.11	0.15
KG000000	11/19/97	0.8	0.58	0.05	0.01	0.18
KG000000	12/17/97	1.0	0.30	0.04	0.10	0.28
DV000000	10/16/96	0.2	0.05	< 0.01	< 0.01	0.07
DV000000	2/19/97	0.3	0.38	< 0.01	0.02	0.06
DV000000	6/18/97	0.3	0.13	< 0.01	< 0.01	0.02
DV000000	9/17/97	0.3	< 0.01	< 0.01	< 0.01	< 0.01
DV000000	10/15/97	0.3	0.01	< 0.01	0.01	0.02
DV001000	7/24/96	0.3	< 0.01	< 0.01	< 0.01	0.01
DV001000	9/3/96	0.3	< 0.01	< 0.01	< 0.01	< 0.01
DV001000	9/18/96	0.3	0.01	< 0.01	< 0.01	0.01
DV001000	10/22/96	0.3	0.02	0.01	< 0.01	0.01
DV001000	11/12/96	0.4	0.02	0.03	< 0.01	< 0.01
DV001000	11/20/96	0.3	0.06	< 0.01	< 0.01	0.02
DV001000	12/18/96	0.4	0.39	< 0.01	< 0.01	0.04
DV001000	1/15/97	0.4	0.47	< 0.01	0.01	0.06
DV001000	3/18/97	0.6	< 0.01	0.01	< 0.01	0.04
DV001000	4/22/97	0.6	< 0.01	0.01	< 0.01	0.02
DV001000	5/13/97	0.5	< 0.01	0.02	< 0.01	0.02
DV001000	6/17/97	0.4	< 0.01	< 0.01	< 0.01	0.02
DV001000	8/29/97	0.4	< 0.01	< 0.01	< 0.01	< 0.01
DV001000	9/16/97	0.3	< 0.01	< 0.01	< 0.01	< 0.01
DV001000	11/24/97	0.4	0.01	0.03	< 0.01	< 0.01

Table C-4 (Con't)
Nutrient Concentrations in the SWP

STATION	DATE	ORGANIC	NITRATE+	DISSOLVED	ORTHO-	TOTAL PHOSPHORUS (mg/L)
		NITROGEN	NITRITE	AMMONIA	PHOSPHATE	
DV001000	12/11/97	0.4	0.08	0.02	0.01	0.03
KB001638	4/16/97	0.4	0.71	0.01	0.06	0.10
KB001638	5/21/97	0.8	0.61	0.02	0.05	0.14
KB001638	6/18/97	0.5	0.80	0.05	0.12	0.17
KB001638	7/16/97	0.4	0.20	0.01	0.06	0.11
KB001638	8/20/97	0.4	0.09	< 0.01	0.07	0.12
KB001638	9/17/97	0.5	0.06	< 0.01	0.05	0.10
KB001638	10/15/97	0.3	0.26	0.01	0.04	0.05
KB001638	11/19/97	0.4	0.60	0.01	0.04	0.10
KB001638	12/17/97	0.5	0.89	0.04	0.06	0.11
KA000331	1/17/96	0.9	0.81	0.08	0.04	0.20
KA000331	2/21/96	0.5	1.20	0.04	0.10	0.14
KA000331	3/20/96	0.2	0.50	0.03	0.06	0.07
KA000331	4/17/96	0.3	0.48	0.04	0.06	0.08
KA000331	5/15/96	0.3	0.76	0.04	0.10	0.12
KA000331	6/19/96	0.4	0.46	0.02	0.06	0.12
KA000331	7/17/96	0.3	0.21	0.02	0.06	0.10
KA000331	8/21/96	0.5	0.19	0.03	0.06	0.09
KA000331	9/18/96	0.3	0.31	0.02	0.05	0.08
KA000331	10/16/96	0.2	0.43	0.04	0.07	0.11
KA000331	11/20/96	0.5	0.56	0.11	0.02	0.09
KA000331	12/18/96	0.6	0.67	0.14	0.12	0.17
KA000331	1/15/97	0.6	0.72	0.11	0.09	0.14
KA000331	2/19/97	0.3	0.52	0.04	0.08	0.10
KA000331	3/19/97	0.4	0.76	0.13	0.07	0.10
KA000331	4/16/97	0.3	0.75	0.07	0.06	0.09
KA000331	5/21/97	0.8	0.73	0.25	0.10	0.13
KA000331	6/18/97	0.5	0.62	0.04	0.08	0.15
KA000331	7/16/97	0.4	0.28	0.04	0.08	0.12
KA000331	8/20/97	0.4	0.09	0.03	0.07	0.11
KA000331	9/17/97	0.0	0.28	0.02	0.07	0.10
KA000331	10/15/97	0.3	0.38	0.04	0.06	0.09
KA000331	11/19/97	0.4	0.50	0.08	0.04	0.10
KA000331	12/17/97	0.5	0.88	0.14	0.06	0.12
KA030341	1/17/96	0.7	1.03	< 0.01	0.07	0.12
KA030341	2/21/96	0.8	1.58	0.03	0.15	0.19
KA030341	3/20/96	0.5	1.06	< 0.01	0.09	0.13
KA030341	4/17/96	0.6	0.64	< 0.01	0.08	0.10
KA030341	5/15/96	0.9	0.39	< 0.01	0.10	0.18
KA030341	6/19/96	0.4	0.76	< 0.01	0.10	0.17
KA030341	7/17/96	0.7	0.58	< 0.01	0.23	0.31
KA030341	8/21/96	0.4	0.53	0.01	0.08	0.14
KA030341	9/18/96	0.4	0.37	< 0.01	0.07	0.16
KA030341	10/16/96	0.2	0.20	< 0.01	0.06	0.10
KA030341	11/20/96	0.3	0.42	< 0.01	0.05	0.07
KA030341	12/18/96	0.2	0.62	0.01	0.06	0.08
KA030341	1/13/97	0.3	0.92	0.02	0.08	0.08
KA030341	2/19/97	0.3	0.28	0.01	0.03	0.05
KA030341	3/19/97	0.4	0.43	0.02	0.05	0.14
KA030341	4/16/97	0.5	1.00	0.01	0.08	0.20
KA030341	5/21/97	0.5	0.66	0.01	0.09	0.15
KA030341	6/18/97	0.4	0.69	0.01	0.10	0.17
KA030341	7/16/97	0.4	0.45	0.01	0.09	0.15
KA030341	8/20/97	0.6	0.14	< 0.01	0.05	0.14
KA030341	9/17/97	0.4	0.44	0.02	0.09	0.14
KA030341	10/15/97	0.4	0.24	0.02	0.09	0.11
KA030341	11/19/97	0.3	0.70	0.01	0.06	0.11
KA030341	12/17/97	0.4	0.75	< 0.01	0.06	0.13
KA040341	1/17/96	0.7	0.18	< 0.01	< 0.01	0.04
KA040341	2/21/96	0.6	0.88	0.02	0.05	0.07
KA040341	3/20/96	0.9	0.69	0.04	0.04	0.04
KA040341	4/17/96	0.6	0.63	0.03	0.09	0.09
KA040341	6/19/96	0.5	0.75	0.02	0.10	0.17
KA040341	7/17/96	0.6	0.60	< 0.01	0.09	0.14
KA040341	8/21/96	0.4	0.44	< 0.01	0.08	0.12
KA040341	9/18/96	0.4	0.34	< 0.01	0.08	0.14
KA040341	10/16/96	0.5	0.18	0.02	0.06	0.10
KA040341	11/20/96	0.4	0.30	< 0.01	0.03	0.08
KA040341	12/18/96	0.5	0.07	0.04	0.03	0.08
KA040341	1/13/97	0.4	0.08	0.03	0.02	0.04
KA040341	2/19/97	0.6	0.19	0.10	0.01	0.05
KA040341	3/19/97	0.5	0.65	0.02	0.07	0.15
KA040341	4/16/97	0.7	1.00	0.02	0.10	0.19
KA040341	5/21/97	0.5	0.65	< 0.01	0.09	0.17
KA040341	6/18/97	0.4	0.64	0.01	0.09	0.14
KA040341	7/16/97	0.3	0.56	0.02	0.09	0.10
KA040341	8/20/97	0.4	0.25	< 0.01	0.07	0.13
KA040341	9/17/97	0.5	0.44	0.02	0.09	0.15
KA040341	10/15/97	0.3	0.22	< 0.01	0.07	0.09
KA040341	11/19/97	0.3	0.44	< 0.01	0.05	0.09
KA040341	12/16/97	0.3	0.68	< 0.01	0.06	0.09
KA040341	1/17/96	0.4	0.63	0.01	0.06	0.08
KA041288	2/21/96	1.2	0.90	0.25	0.02	0.27
KA041288	3/20/96	0.3	0.69	0.04	0.04	0.06
KA041288	4/17/96	0.8	0.65	0.04	0.06	0.11
KA041288	5/15/96	1.3	0.24	0.03	0.04	0.09
KA041288	6/19/96	0.4	0.64	0.03	0.09	0.12
KA041288	7/17/96	0.3	0.61	0.03	0.09	0.11
KA041288	8/21/96	0.4	0.54	0.02	0.09	0.10

Table C-4 (Con't)
Nutrient Concentrations in the SWP

STATION	DATE	ORGANIC	NITRATE+	DISSOLVED	ORTHO-	TOTAL PHOSPHORUS (mg/L)
		NITROGEN	NITRITE	AMMONIA	PHOSPHATE (mg/L as P)	
KA041288	9/15/96	0.2	0.43	0.01	0.08	0.11
KA041288	10/16/96	0.3	0.26	0.02	0.09	0.10
KA041288	11/20/96	0.2	0.45	0.01	0.05	0.08
KA041288	12/18/96	0.4	0.49	0.07	0.04	0.08
KA041288	1/13/97	0.5	0.64	0.20	< 0.01	0.06
KA041288	2/19/97	0.1	0.20	< 0.01	< 0.01	0.02
KA041288	3/19/97	0.6	0.32	0.02	< 0.01	0.05
KA041288	4/16/97	0.4	0.72	0.02	0.05	0.10
KA041288	5/21/97	0.5	0.58	0.09	0.08	0.11
KA041288	6/18/97	0.4	0.56	0.02	0.07	0.11
KA041288	7/16/97	0.4	0.56	0.02	0.09	0.11
KA041288	8/20/97	0.4	0.36	< 0.01	0.08	0.11
KA041288	9/17/97	0.3	0.25	0.02	0.08	0.10
KA041288	9/17/97	0.3	0.24	0.02	0.08	0.09
KA041288	10/15/97	0.3	0.37	< 0.01	0.10	0.11
KA041288	11/19/97	0.3	0.38	< 0.01	0.08	0.11
KA041288	12/17/97	0.3	0.43	< 0.01	0.07	0.09
SL001000	1/16/96	0.4	1.20	< 0.01	0.10	0.14
SL001000	2/20/96	0.6	0.69	0.04	0.08	0.13
SL001000	3/20/96	0.9	0.56	< 0.01	0.07	0.15
SL001000	4/16/96	0.4	0.84	< 0.01	0.08	0.12
SL001000	4/16/96	0.4	0.84	< 0.01	0.08	0.12
SL001000	5/14/96	0.7	0.84	< 0.01	0.08	0.12
SL001000	6/18/96	0.5	0.82	0.03	0.08	0.10
SL001000	7/16/96	0.5	0.58	0.02	0.07	0.10
SL001000	8/19/96	0.3	0.70	< 0.01	0.08	0.12
SL001000	9/17/96	0.3	0.58	0.02	0.07	0.10
SL001000	10/15/96	0.3	0.50	0.02	0.08	0.12
SL001000	11/19/96	0.4	0.77	< 0.01	0.06	0.10
SL001000	12/17/96	0.3	0.56	< 0.01	0.09	0.11
SL001000	1/14/97	0.3	0.76	< 0.01	0.09	0.11
SL001000	2/18/97	0.3	0.93	< 0.01	0.08	0.10
SL001000	3/18/97	0.5	0.48	< 0.01	0.06	0.11
SL001000	4/14/97	0.4	0.64	0.07	0.08	0.11
SL001000	5/20/97	0.5	0.50	0.06	0.07	0.11
SL001000	6/17/97	0.4	0.52	< 0.01	0.07	0.09
SL001000	7/14/97	0.6	0.33	< 0.01	0.05	0.12
SL001000	8/19/97	0.6	0.23	< 0.01	0.06	0.11
SL001000	9/16/97	0.4	0.20	0.02	0.08	0.11
SL001000	10/14/97	0.3	0.35	< 0.01	0.13	0.14
SL001000	11/18/97	0.3	1.39	0.04	0.12	0.16
SL001000	12/16/97	0.2	0.69	< 0.01	0.10	0.11
SL005000	1/16/96	0.2	0.85	0.01	0.10	0.12
SL005000	2/20/96	0.3	0.90	< 0.01	0.11	0.12
SL005000	3/18/96	0.8	0.60	< 0.01	0.08	0.16
SL005000	4/16/96	0.3	0.84	< 0.01	0.09	0.11
SL005000	5/14/96	0.4	0.78	< 0.01	0.09	0.11
SL005000	6/18/96	0.4	0.80	0.01	0.08	0.10
SL005000	7/16/96	0.4	0.72	0.02	0.09	0.11
SL005000	8/19/96	0.4	0.66	< 0.01	0.08	0.11
SL005000	9/17/96	0.4	0.55	0.02	0.06	0.11
SL005000	10/15/96	0.3	0.46	0.01	0.08	0.12
SL005000	11/19/96	0.3	0.51	< 0.01	0.05	0.12
SL005000	12/17/96	0.2	0.49	< 0.01	0.09	0.10
SL005000	1/14/97	0.3	0.77	< 0.01	0.08	0.11
SL005000	2/18/97	0.3	1.20	0.02	0.09	0.10
SL005000	3/18/97	0.4	0.80	0.01	0.07	0.10
SL005000	4/14/97	0.4	0.65	0.07	0.08	0.11
SL005000	5/20/97	0.4	0.51	0.06	0.08	0.10
SL005000	6/17/97	0.3	0.52	0.02	0.07	0.09
SL005000	7/14/97	0.4	0.40	0.03	0.07	0.11
SL005000	8/19/97	0.6	0.23	0.04	0.08	0.11
SL005000	9/16/97	0.6	0.05	< 0.01	0.07	0.13
SL005000	10/14/97	0.4	0.30	< 0.01	0.13	0.14
SL005000	11/18/97	0.8	0.40	< 0.01	0.11	0.18
SL005000	12/17/97	0.3	0.62	< 0.01	0.09	0.13
CA002000	1/16/96	0.4	0.29	< 0.01	0.03	0.04
CA002000	2/20/96	0.3	0.28	< 0.01	0.01	0.05
CA002000	3/18/96	0.4	0.10	< 0.01	0.02	0.05
CA002000	4/15/96	0.6	0.10	0.01	< 0.01	0.03
CA002000	5/13/96	0.5	< 0.01	< 0.01	< 0.01	0.04
CA002000	6/17/96	0.5	0.02	0.03	< 0.01	0.02
CA002000	7/15/96	0.4	< 0.01	< 0.01	< 0.01	0.02
CA002000	9/16/96	0.4	0.02	< 0.01	< 0.01	0.02
CA002000	10/15/96	0.4	0.07	< 0.01	< 0.01	0.07
CA002000	11/19/96	0.4	0.30	< 0.01	0.02	0.02
CA002000	12/16/96	0.2	0.38	< 0.01	0.03	0.04
CA002000	1/13/97	0.3	0.41	< 0.01	0.04	0.04
CA002000	2/18/97	0.3	0.42	< 0.01	0.04	0.06
CA002000	3/17/97	0.3	0.21	< 0.01	0.01	0.03
CA002000	4/14/97	0.5	0.07	< 0.01	< 0.01	0.04
CA002000	5/19/97	0.6	< 0.01	< 0.01	< 0.01	0.04
CA002000	6/16/97	0.4	0.02	0.02	< 0.01	0.02
CA002000	7/14/97	0.8	< 0.01	< 0.01	< 0.01	0.02
CA002000	8/18/97	0.4	< 0.01	< 0.01	< 0.01	0.02
CA002000	9/15/97	0.5	< 0.01	< 0.01	< 0.01	0.03
CA002000	10/14/97	0.5	0.07	0.03	< 0.01	0.02
CA002000	11/17/97	0.2	0.24	0.01	0.02	0.03
CA002000	12/15/97	0.2	0.34	< 0.01	0.03	0.05

Table C-4 (Con't)
Nutrient Concentrations in the SWP

STATION	DATE	ORGANIC	NITRATE+	DISSOLVED	ORTHO-	TOTAL
		NITROGEN	NITRITE	AMMONIA	PHOSPHATE	
(mg/L)		(mg/L as N)		(mg/L as N)	(mg/L as P)	(mg/L)
PE002000	1/16/96	0.5	< 0.01	0.02	0.03	0.06
PE002000	2/20/96	0.3	< 0.01	0.02	0.02	0.04
PE002000	3/19/96	0.8	< 0.01	< 0.01	< 0.01	0.08
PE002000	4/16/96	0.5	< 0.01	< 0.01	< 0.01	0.02
PE002000	5/13/96	0.5	< 0.01	< 0.01	< 0.01	0.02
PE002000	6/17/96	0.4	< 0.01	< 0.01	< 0.01	0.02
PE002000	7/18/96	0.5	< 0.01	< 0.01	< 0.01	0.03
PE002000	8/21/96	0.5	< 0.01	< 0.01	< 0.01	< 0.01
PE002000	9/16/96	1.2	< 0.01	< 0.01	< 0.01	0.03
PE002000	10/15/96	0.6	0.02	< 0.01	< 0.01	0.08
PE002000	11/18/96	0.6	0.03	0.04	0.01	0.07
PE002000	12/16/96	0.4	0.03	0.06	0.04	0.06
PE002000	1/14/97	0.6	0.03	0.04	0.03	0.06
PE002000	2/18/97	0.4	0.12	0.02	0.05	0.07
PE002000	3/18/97	0.5	0.02	0.01	0.01	0.03
PE002000	4/15/97	0.4	0.04	0.02	0.02	0.04
PE002000	5/20/97	0.4	< 0.01	< 0.01	< 0.01	0.02
PE002000	6/16/97	0.4	0.07	< 0.01	< 0.01	< 0.02
PE002000	7/14/97	0.5	0.02	0.02	< 0.01	< 0.01
PE002000	8/18/97	0.4	0.01	< 0.01	< 0.01	0.01
PE002000	9/15/97	0.5	< 0.01	0.02	< 0.01	0.02
PE002000	10/14/97	0.4	0.02	0.01	0.03	0.05
PE002000	11/17/97	0.4	0.11	0.03	0.05	0.08
PE002000	12/15/97	0.3	0.20	< 0.01	0.05	0.07
PY001000	1/16/96	0.3	0.49	< 0.01	0.05	0.06
PY001000	2/20/96	0.2	0.56	< 0.01	0.05	0.05
PY001000	3/19/96	0.6	0.71	< 0.01	0.05	0.11
PY001000	4/15/96	0.7	0.66	0.06	0.07	0.09
PY001000	5/14/96	2.1	0.30	0.03	0.06	0.07
PY001000	6/18/96	0.5	0.68	< 0.01	0.05	0.08
PY001000	7/16/96	0.5	0.53	0.03	0.05	0.07
PY001000	9/17/96	0.3	0.35	0.02	0.06	0.27
PY001000	10/15/96	0.2	0.29	0.02	0.05	0.08
PY001000	11/18/96	0.2	0.40	< 0.01	0.05	0.05
PY001000	12/16/96	0.2	0.46	< 0.01	0.06	0.07
PY001000	1/13/97	0.2	0.51	< 0.01	0.06	0.07
PY001000	2/18/97	< 0.1	0.54	< 0.01	0.06	< 0.01
PY001000	3/18/97	0.6	0.32	< 0.01	0.03	0.08
PY001000	4/15/97	0.4	0.55	< 0.01	0.04	0.08
PY001000	5/19/97	0.4	0.58	0.02	0.06	0.09
PY001000	6/16/97	0.3	0.54	0.03	0.06	0.08
PY001000	7/15/97	0.4	0.46	0.02	0.05	0.06
PY001000	8/19/97	0.3	0.43	< 0.01	0.04	0.06
PY001000	9/16/97	0.3	0.40	0.01	0.04	0.05
PY001000	10/15/97	0.3	0.41	< 0.01	0.06	0.06
PY001000	11/18/97	0.4	0.44	< 0.01	0.06	0.08
PY001000	12/16/97	0.2	0.52	< 0.01	0.06	0.08
S1002000	1/16/96	0.3	0.64	< 0.01	0.06	0.08
S1002000	2/20/96	0.8	0.51	0.06	0.04	0.06
S1002000	3/18/96	0.6	0.58	0.02	0.02	0.06
S1002000	4/15/96	0.8	0.60	< 0.01	0.05	0.08
S1002000	5/14/96	0.3	0.25	0.02	0.04	0.07
S1002000	6/19/96	0.6	0.70	0.03	0.09	0.11
S1002000	7/16/96	0.4	0.58	0.02	0.09	0.10
S1002000	8/21/96	0.9	0.52	< 0.01	0.09	0.10
S1002000	9/17/96	0.3	0.42	< 0.01	0.08	0.10
S1002000	10/16/96	0.2	0.39	0.01	0.07	0.10
S1002000	11/19/96	0.2	0.42	0.01	0.05	0.08
S1002000	12/16/96	0.4	0.47	0.08	< 0.01	0.08
S1002000	1/14/97	0.8	0.72	0.23	< 0.01	0.09
S1002000	2/19/97	0.6	0.77	0.24	< 0.01	0.07
S1002000	2/20/97	0.6	0.77	0.23	< 0.01	0.07
S1002000	3/19/97	0.4	0.57	0.14	< 0.01	0.02
S1002000	4/14/97	0.4	0.66	< 0.01	0.04	0.09
S1002000	5/19/97	0.4	0.57	0.08	0.08	0.11
S1002000	6/16/97	0.5	0.41	0.02	0.06	0.10
S1002000	7/14/97	0.6	0.62	0.01	0.11	0.15
S1002000	8/19/97	0.4	0.38	< 0.01	0.08	0.11
S1002000	9/16/97	0.4	0.23	0.04	0.08	0.08
S1002000	10/14/97	0.3	0.39	< 0.01	0.08	0.11
S1002000	11/18/97	0.3	0.38	0.01	0.08	0.12
S1002000	12/15/97	0.2	0.43	< 0.01	0.08	0.10

Table C-5
Total Trihalomethane Formation Potential Concentrations in the SWP

STATION	DATE	CHLOROFORM	CONCENTRATION, ug/L			TOTAL TRIHALOMETHANE FORMATION POTENTIAL
			DIBROMO- CHLOROFORM	BROMODI- CHLOROFORM	BROMOFORM	
KG000000	1/17/96	1300	< 10	30	< 10	1350
KG000000	2/21/96	1700	< 10	32	< 10	1752
KG000000	3/20/96	1600	< 10	40	< 10	1660
KG000000	4/17/96	880	< 10	51	< 10	951
KG000000	5/15/96	440	< 10	38	< 10	498
KG000000	6/19/96	440	< 10	40	< 10	500
KG000000	7/17/96	500	< 10	39	< 10	559
KG000000	8/21/96	440	< 10	27	< 10	487
KG000000	9/18/96	450	< 10	28	< 10	498
KG000000	10/16/96	410	< 10	38	< 10	468
KG000000	11/20/96	490	< 10	39	< 10	549
KG000000	12/18/96	820	< 10	45	< 10	885
KG000000	1/15/97	1400	< 10	28	< 10	1448
KG000000	2/19/97	1100	< 10	59	< 10	1179
KG000000	3/19/97	800	< 10	55	< 10	875
KG000000	4/16/97	640	< 10	68	< 10	728
KG000000	5/21/97	480	< 10	47	< 10	547
KG000000	6/18/97	500	< 10	54	< 10	574
KG000000	7/16/97	820	< 10	46	< 10	886
KG000000	8/20/97	610	< 10	32	< 10	662
KG000000	9/17/97	600	< 10	32	< 10	652
KG000000	10/15/97	560	< 10	38	< 10	618
KG000000	11/19/97	750	< 10	40	< 10	810
KG000000	12/17/97	950	< 10	48	< 10	1018
KB001638	4/16/97	380	< 10	78	< 10	478
KB001638	5/21/97	440	18	100	< 10	568
KB001638	6/18/97	520	12	100	< 10	642
KB001638	7/16/97	320	< 10	74	< 10	414
KB001638	8/20/97	320	< 10	73	< 10	413
KB001638	9/17/97	290	< 10	61	< 10	371
KB001638	10/15/97	210	45	110	< 10	375
KB001638	11/19/97	240	75	140	< 10	465
KB001638	12/17/97	320	88	170	< 10	588
KA000331	1/17/96	700	< 10	55	< 10	775
KA000331	2/21/96	440	< 10	70	< 10	530
KA000331	3/20/96	380	< 10	52	< 10	452
KA000331	4/17/96	410	< 10	56	< 10	486
KA000331	5/15/96	240	13	60	< 10	323
KA000331	6/19/96	320	< 10	45	< 10	385
KA000331	7/17/96	300	< 10	35	< 10	355
KA000331	8/21/96	270	13	57	< 10	350
KA000331	9/18/96	240	11	47	< 10	308
KA000331	10/16/96	230	23	73	< 10	336
KA000331	11/20/96	200	40	100	< 10	350
KA000331	12/18/96	410	< 10	78	< 10	508
KA000331	1/15/97	500	< 10	38	< 10	558
KA000331	2/19/97	490	< 10	44	< 10	554
KA000331	3/19/97	520	< 10	88	< 10	628
KA000331	4/16/97	410	< 10	78	< 10	508
KA000331	5/21/97	360	18	98	< 10	486
KA000331	6/18/97	380	< 10	82	< 10	482
KA000331	7/16/97	310	< 10	82	< 10	412
KA000331	8/20/97	300	< 10	72	< 10	392
KA000331	9/17/97	290	< 10	54	< 10	364
KA000331	10/15/97	210	56	120	< 10	396
KA000331	11/19/97	250	76	150	< 10	486
KA000331	12/17/97	300	88	160	< 10	558
KA006633	2/21/96	560	< 10	78	< 10	658
KA006633	5/14/96	310	11	66	< 10	397
KA006633	8/20/96	260	11	54	< 10	335
KA006633	11/20/96	190	32	86	< 10	318
KA006633	2/19/97	440	< 10	40	< 10	500
KA006633	5/21/97	330	17	92	< 10	449
KA006633	8/20/97	290	< 10	68	< 10	378
KA006633	11/19/97	210	69	130	< 10	419
KA007089	1/17/96	560	13	95	< 10	678
KA007089	2/21/96	490	< 10	75	< 10	585
KA007089	3/20/96	420	< 10	62	< 10	502
KA007089	4/17/96	370	12	76	< 10	468
KA007089	5/14/96	290	22	83	< 10	405
KA007089	6/19/96	320	14	66	< 10	410
KA007089	7/17/96	320	30	91	< 10	451
KA007089	8/20/96	260	24	77	< 10	371
KA007089	9/18/96	250	12	54	< 10	326
KA007089	10/16/96	220	20	65	< 10	315
KA007089	11/20/96	180	29	80	< 10	299
KA007089	12/18/96	330	< 10	73	< 10	423
KA007089	1/15/97	500	< 10	49	< 10	569
KA007089	2/19/97	470	< 10	48	< 10	538
KA007089	3/19/97	470	< 10	78	< 10	568
KA007089	4/16/97	400	17	92	< 10	519
KA007089	5/21/97	270	30	96	< 10	406
KA007089	6/18/97	340	25	100	< 10	475
KA007089	7/16/97	340	31	110	< 10	491
KA007089	8/19/97	360	16	96	< 10	482
KA007089	9/17/97	410	< 10	83	< 10	513
KA007089	10/15/97	230	42	110	< 10	392

Table C-5 (Con't)
Total Trihalomethane Formation Potential Concentrations in the SWP

STATION	DATE	CONCENTRATION, ug/L				TOTAL TRIHALOMETHANE FORMATION POTENTIAL
		CHLOROFORM	DIBROMO- CHLOROFORM	BROMODI- CHLOROFORM	BROMOFORM	
KA007089	11/19/97	240	65	130	< 10	445
KA007089	12/17/97	290	85	160	< 10	545
KA017226	2/21/96	620	< 10	78	< 10	718
KA017226	5/14/96	290	27	89	< 10	416
KA017226	8/21/96	270	26	79	< 10	385
KA017226	11/20/96	180	< 10	69	< 10	280
KA017226	2/19/97	490	< 10	52	< 10	562
KA017226	5/21/97	290	27	99	< 10	426
KA017226	8/20/97	270	28	96	< 10	404
KA017226	11/19/97	220	97	170	< 10	497
KA020794	1/9/97	440	< 10	70	< 10	530
KA021031	1/13/97	440	< 10	66	< 10	526
KA021031	1/28/97	380	< 10	66	< 10	466
KA021031	2/11/97	430	< 10	71	< 10	521
KA024454	9/17/96	230	14	56	< 10	310
KA024454	10/15/96	220	12	51	< 10	293
KA024454	11/19/96	180	20	73	< 10	283
KA024454	12/17/96	180	37	89	< 10	316
KA024454	1/14/97	510	< 10	< 10	< 10	540
KA024454	2/18/97	480	< 10	< 10	< 10	510
KA024454	3/18/97	360	< 10	54	< 10	434
KA024454	4/15/97	360	16	86	< 10	472
KA024454	5/20/97	270	26	94	< 10	400
KA024454	6/17/97	310	31	110	< 10	461
KA024454	7/15/97	270	26	93	< 10	399
KA024454	8/19/97	260	30	98	< 10	398
KA024454	9/16/97	250	< 10	60	< 10	330
KA024454	10/14/97	240	< 10	64	< 10	324
KA024454	11/18/97	190	70	130	< 10	400
KA024454	12/16/97	200	57	110	< 10	377
KA030341	1/17/96	290	32	96	< 10	428
KA030341	2/20/96	600	11	97	< 10	718
KA030341	3/20/96	470	< 10	68	< 10	558
KA030341	4/17/96	370	10	70	< 10	460
KA030341	5/15/96	330	24	89	< 10	453
KA030341	6/19/96	350	30	94	< 10	484
KA030341	7/17/96	420	24	92	< 10	546
KA030341	8/21/96	290	27	86	< 10	413
KA030341	9/18/96	220	17	58	< 10	305
KA030341	10/16/96	210	12	50	< 10	282
KA030341	11/20/96	170	20	67	< 10	267
KA030341	12/18/96	170	24	72	< 10	276
KA030341	1/13/97	280	28	96	< 10	414
KA030341	2/19/97	470	< 10	< 10	< 10	500
KA030341	3/19/97	340	< 10	61	< 10	421
KA030341	4/16/97	340	20	91	< 10	461
KA030341	5/21/97	320	26	98	< 10	454
KA030341	6/18/97	360	27	110	< 10	507
KA030341	7/16/97	250	16	78	< 10	354
KA030341	8/19/97	270	27	96	< 10	403
KA030341	9/17/97	270	< 10	63	< 10	353
KA030341	10/15/97	230	< 10	63	< 10	313
KA030341	11/19/97	190	76	140	< 10	416
KA030341	12/17/97	180	61	110	< 10	361
KA040341	2/21/96	480	< 10	84	< 10	584
KA040341	5/15/96	330	28	95	< 10	463
KA040341	11/20/96	200	10	57	< 10	277
KA040341	2/19/97	250	20	85	< 10	365
KA040341	5/21/97	430	26	120	< 10	586
KA040341	8/20/97	270	14	79	< 10	373
KA040341	11/19/97	210	55	120	< 10	395
KA041288	1/17/96	270	19	74	< 10	373
KA041288	2/21/96	870	< 10	59	< 10	949
KA041288	3/20/96	360	11	73	< 10	454
KA041288	4/17/96	460	11	78	< 10	559
KA041288	5/15/96	330	18	82	< 10	440
KA041288	6/19/96	300	22	78	< 10	410
KA041288	7/17/96	300	27	85	< 10	422
KA041288	8/21/96	240	23	72	< 10	345
KA041288	9/18/96	220	19	61	< 10	310
KA041288	10/16/96	230	19	68	< 10	327
KA041288	11/20/96	210	14	63	< 10	297
KA041288	12/18/96	190	< 10	54	< 10	264
KA041288	1/13/97	270	< 10	58	< 10	348
KA041288	2/19/97	190	< 10	< 10	< 10	220
KA041288	3/19/97	380	< 10	55	< 10	455
KA041288	4/16/97	350	11	78	< 10	449
KA041288	5/21/97	310	22	95	< 10	437
KA041288	6/18/97	310	30	110	< 10	460
KA041288	7/16/97	260	27	94	< 10	391
KA041288	8/20/97	250	17	78	< 10	355
KA041288	9/17/97	240	17	77	< 10	344
KA041288	10/15/97	240	< 10	66	< 10	326
KA041288	11/19/97	240	10	77	< 10	337
KA041288	12/17/97	190	27	74	< 10	301
KC000934	8/20/96	280	28	85	< 10	403
KC000934	9/17/96	240	13	55	< 10	318

Table C-5 (Con't)
Total Trihalomethane Formation Potential Concentrations in the SWP

STATION	DATE	CHLOROFORM	CONCENTRATION, ug/L			TOTAL TRIHALOMETHANE FORMATION POTENTIAL
			DIBROMO- CHLOROFORM	BROMODI- CHLOROFORM	BROMOFORM	
KC000934	10/15/96	220	15	58	< 10	303
KC000934	11/19/96	210	23	76	< 10	319
KC000934	12/17/96	170	30	80	< 10	290
KC000934	1/13/97	260	46	110	< 10	426
KC000934	2/18/97	330	44	120	< 10	504
KC000934	3/18/97	360	< 10	61	< 10	441
KC000934	4/15/97	340	25	100	< 10	475
KC000934	5/20/97	330	26	110	< 10	476
KC000934	6/17/97	320	32	110	< 10	472
KC000934	7/15/97	260	32	100	< 10	402
KC000934	9/16/97	280	< 10	67	< 10	367
KC000934	10/14/97	240	15	79	< 10	344
KC000934	12/15/97	210	63	120	< 10	403
CA002000	2/20/96	270	22	80	< 10	382
CA002000	5/13/96	330	14	72	< 10	426
CA002000	8/19/96	340	26	88	< 10	464
CA002000	11/19/96	220	18	73	< 10	321
CA002000	2/18/97	270	18	79	< 10	377
CA002000	5/19/97	340	17	87	< 10	454
CA002000	8/18/97	320	17	83	< 10	430
CA002000	11/17/97	260	11	79	< 10	360
DMC06716	1/17/96	390	55	140	< 10	595
DMC06716	2/21/96	430	12	82	< 10	534
DMC06716	3/20/96	380	< 10	54	< 10	454
DMC06716	4/17/96	330	15	77	< 10	432
DMC06716	5/14/96	280	16	70	< 10	376
DMC06716	6/19/96	400	< 10	42	< 10	462
DMC06716	7/17/96	320	21	76	< 10	427
DMC06716	8/20/96	270	14	58	< 10	352
DMC06716	9/18/96	240	18	64	< 10	332
DMC06716	10/16/96	210	20	64	< 10	304
DMC06716	11/20/96	180	37	90	< 10	317
DMC06716	12/18/96	390	< 10	29	< 10	439
DMC06716	1/15/97	630	< 10	36	< 10	686
DMC06716	2/19/97	430	< 10	46	< 10	496
DMC06716	3/19/97	360	17	92	< 10	479
DMC06716	4/16/97	350	< 10	72	< 10	442
DMC06716	5/21/97	350	25	100	< 10	485
DMC06716	6/18/97	360	13	91	< 10	474
DMC06716	7/16/97	260	10	73	< 10	353
DMC06716	8/20/97	290	14	84	< 10	398
DMC06716	9/17/97	260	25	96	< 10	391
DMC06716	10/15/97	280	< 10	71	< 10	371
DMC06716	11/19/97	220	64	130	< 10	424
DMC06716	12/17/97	300	67	140	< 10	517

Appendix D

Explanation of a Trilinear Plot

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Explanation of a Trilinear Plot

Trilinear graphs are useful for comparing the characteristics of different water bodies. Streams and groundwater usually exhibit a unique composition of major minerals such as sulfate, chloride, and bicarbonate. A histogram of six major minerals and TDS is converted to three points on a trilinear graph (Figure D-1). The central diamond plot accounts for all cation/anion combinations together. The circle surrounding each icon is TDS (calculated) on a scale provided in the mid-upper left. The larger the circle surrounding each icon, the greater the TDS. The two equilateral triangles present anions and cations separately and show them each as percentages of the total ionic equivalent concentration.

Figure D-1 shows the average mineralogical characteristics of three different water bodies—Salt Creek from the San Luis Canal, Delta water at Banks Pumping Plant, and Feather River water at Thermalito Afterbay. The arrows show which direction the scales should be read. In the central diamond, for example, the anionic composition at Banks Pumping Plant is 36 percent bicarbonate (very little carbonate exists at pH levels observed in the Project) and 64 percent sulfate+chloride. Conversely the anionic composition of water at Thermalito Afterbay is 90 percent bicarbonate and only 10 percent sulfate+chloride. The exact reverse is true for Salt Creek.

The individual anionic components are shown in the lower right triangle. This diagram separates out chloride and sulfate and compares them with bicarbonate. At Banks Pumping Plant, chloride composes 40 percent of the anionic composition, followed by bicarbonate at 36 percent and sulfate at 24 percent. This compares with Thermalito Afterbay, where bicarbonate composes almost 90 percent of the anionic composition and Salt Creek, in which sulfate is the dominant anion with over 80 percent. The cationic composition as shown in the lower left triangle was not as dramatic, with the exception of Thermalito Afterbay. The Afterbay is dominated by calcium as opposed to the other two water bodies, which had similar proportions of sodium+potassium and calcium.

A trilinear plot (also known as a Piper graph) can be used to determine the influence of one water body on another. If two icons, A and B, represent two water bodies, then the icon of the mixture will be positioned between A and B. This assumes that there was no chemical interactions upon mixing that might result in the precipitation of any salts. If equal amounts of water from two different water bodies are mixed, the icon of the resulting mixture would be positioned in a straight line between the two source icons in all three diagrams.

Figure D-1
Explanation of a Trilinear Graph

